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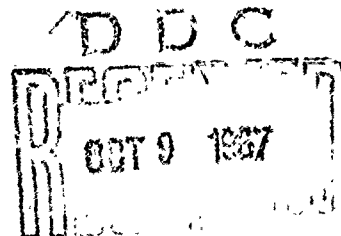
INFORMAL REPORT

TEMPERATURE, SALINITY, AND
DENSITY OF THE WORLD'S SEAS:
BAY OF BENGAL AND ANDAMAN SEA

PAUL E. LAVIOLETTE

*Physical Properties Section
Oceanographic Analysis Division
Marine Sciences Department*

AUGUST 1967



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ABSTRACT

The values and variations of temperature, salinity, and density in the Bay of Bengal and the Andaman Sea depend largely on the monsoonal regime. In addition, because of the semienclosed geography of the region, water masses outside the area can influence the bay waters only from the south. The wind, rain, and land drainage cause a year-round low-salinity surface layer to form. Toward the end of the northeast monsoon, the surface waters in the Bay of Bengal and Andaman sea become warmer and more saline, reaching the year's maximum for temperature and salinity in May. As the southwest monsoon approaches the east coast of India, the warm, highly stratified surface layers cool, tumble, and mix thoroughly.

Although rain sharply affects both the temperature and salinity of the surface layers, the greatest change in salinity occurs during the period of maximum river drainage in September and October.

The disposition of the runoff-induced, low-salinity water varies according to the direction of the monsoonal currents. If the circulation at the head of the bay is clockwise, then the low-salinity water is transported to the eastern part of the bay and into the Andaman Sea. Conversely, a counterclockwise circulation transports these waters westward to the east coast of India.

Upwelling is a prominent feature of both monsoons. During the northeast monsoon it is prevalent along the coasts of Burma and eastern India, whereas during the southwest monsoon it occurs along the coasts of southwestern India and the Malay Peninsula.

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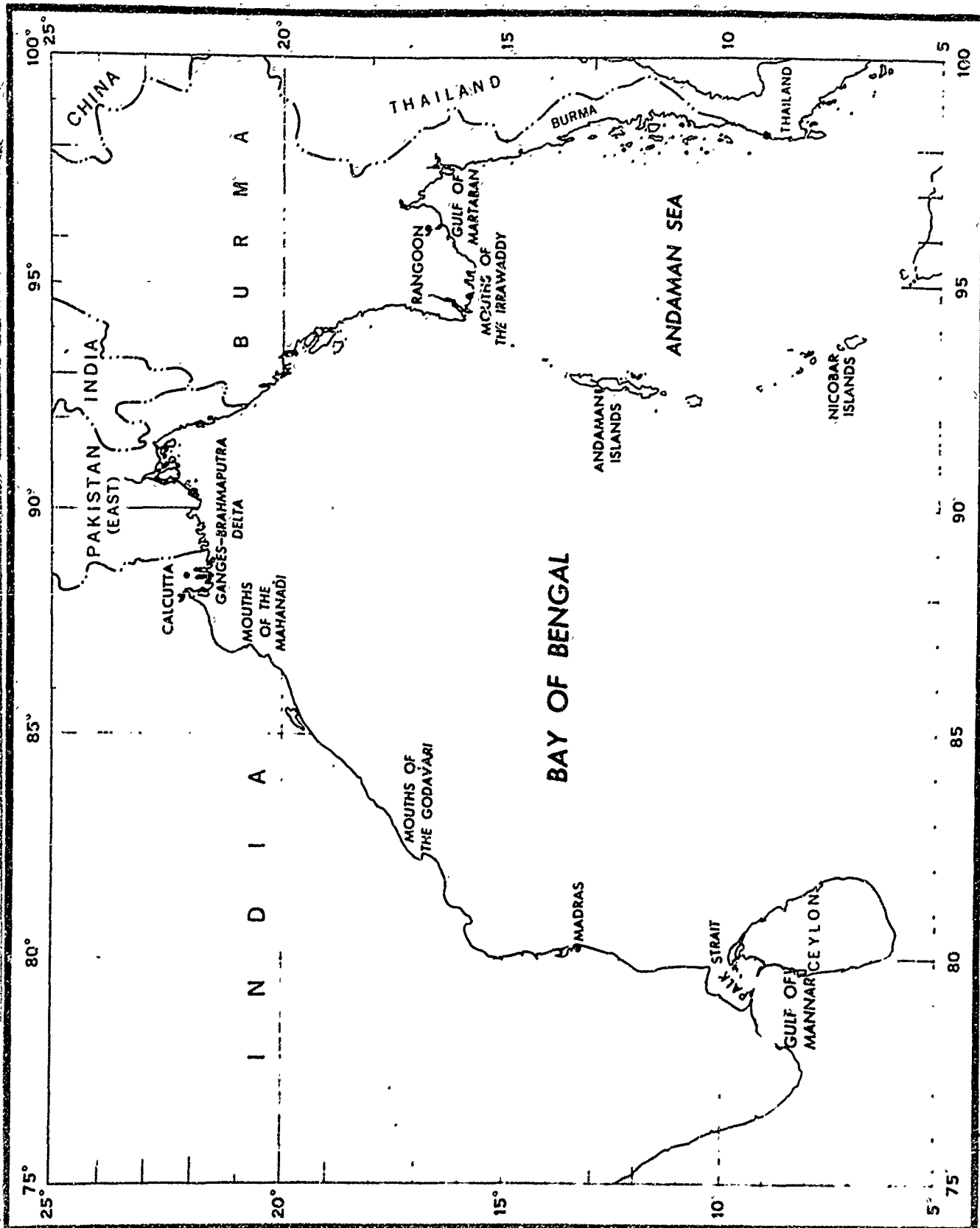


Chart of the Area

INFORMAL MANUSCRIPT

Temperature, Salinity, and Density

of the World's Seas:

Bay of Bengal and Andaman Sea

by

Paul E. La Violette

August 1967

NAVAL OCEANOGRAPHIC OFFICE
WASHINGTON, D. C. 20390

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TEMPERATURE, SALINITY, AND DENSITY OF THE WORLD'S SEAS:

BAY OF BENGAL AND ANDAMAN SEA

INTRODUCTION AND DEFINITIONS

This is part of a series of studies describing the temperature, salinity, and density of various seas of the world. The series was started in response to numerous requests for unclassified reports dealing with specific areas. While this report is as complete as present data make possible, undoubtedly modifications will be necessary with the collection of new data. The amount and source of these data, as well as a discussion on regions and periods needing new data, are given in the sections entitled Data Sources and Bibliography.

In this study, the distribution of physical properties of sea water is represented by mean values. Wherever sufficient data are available, ranges and percent frequencies of occurrence are also presented.

Units are reported in the c.g.s. and English systems, with emphasis placed on the system in which the parameter was measured or analyzed. Thus, temperature is analyzed in degrees Fahrenheit for depths in meters.

a. Temperature -- In this study, temperature is given in both Celsius ($^{\circ}\text{C}.$) and Fahrenheit ($^{\circ}\text{F}.$). Water is considered isothermal when its vertical temperature varies by less than $2.5^{\circ}\text{C}.$ per 100 meters ($1.4^{\circ}\text{F}.$ per 100 feet). A negative thermal gradient, or thermocline, is arbitrarily considered to exist when the reduction of temperature with depth attains or exceeds this amount. If the water is isothermal from the surface to a certain depth, the initial mixed layer is called the isothermal layer, and the depth at which the layer ceases to be isothermal is labeled the isothermal layer depth. In this area, the isothermal layer depth generally corresponds to the top of the thermocline.

b. Salinity -- In this study, salinity is given in parts per thousand (‰). Water of uniform salinity is said to be isohaline, and a well-defined positive gradient of salinity is known as a halocline.

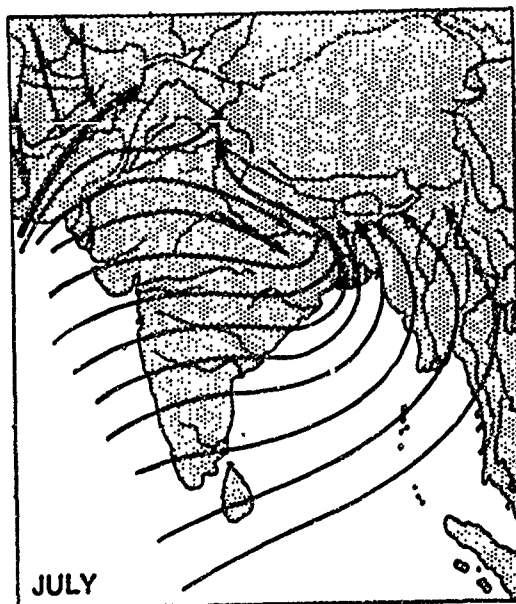
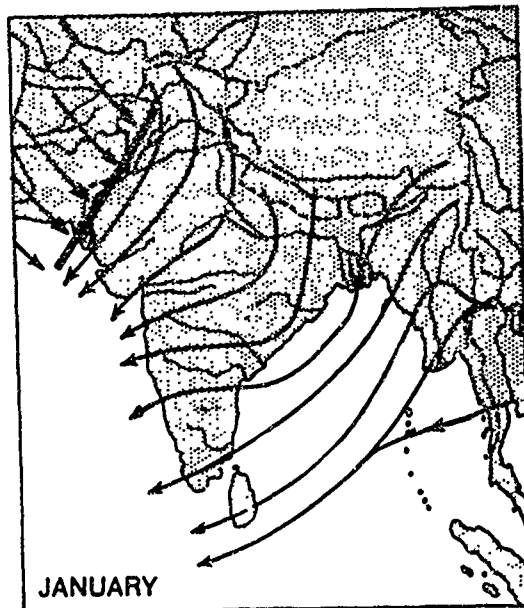
c. Density -- Density as used here is equivalent to specific gravity and represents the ratio at atmospheric pressure of the weight of a given volume of sea water to that of an equal volume of distilled water at 4.0°C.(39.2°F.). For simplicity it is expressed as sigma-t (σ_t), an abbreviated form wherein water whose density is 1.02650 has a σ_t value of 26.50.

A column of water is assumed to be isopycnic, i.e., to have uniform density, if the change in σ_t is equal to or less than 0.65 per 100 meters (0.20 per 100 feet). A vertical gradient of density, known either as a pycnocline or a density layer, is considered to exist when the change in density exceeds the stated isopycnic limits. The pycnocline generally begins at the same depth as the thermocline.

DISCUSSION OF THE AREA

The values and variations of temperature, salinity, and density in the waters of the Bay of Bengal and Andaman Sea are dependent on two factors: 1) the weather cycle and current pattern associated with the monsoonal regime*, and 2) the Asiatic landmass which all but surrounds the bay and sea.

* The monsoons which affect the area are separated into two periods whose names describe the dominant wind pattern of the season: northeast monsoon (December through April) and southwest monsoon (July through October) (Figure 1). The periods May through June and November represent the two transition seasons between the monsoons. These transitional seasons exercise a striking effect on the physical properties of the surface waters as well as on the structure of the water column. Although this effect occurs very quickly during the May through June transition, the time of transition varies geographically from year to year (Figure 2).

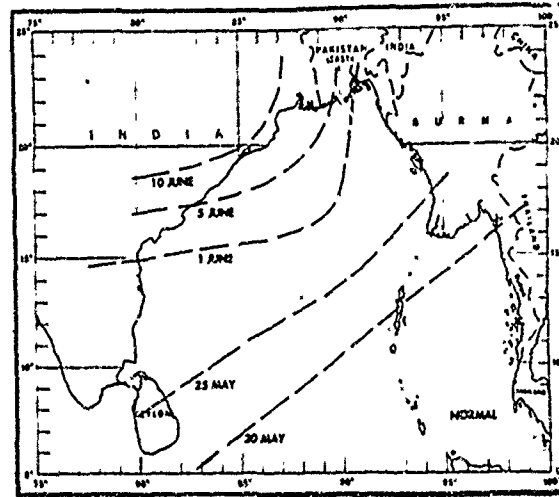
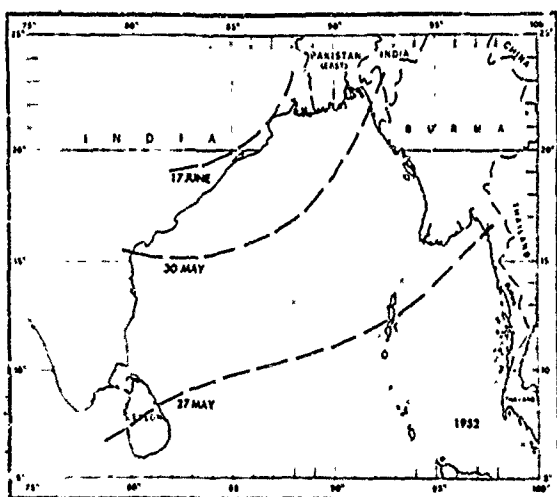
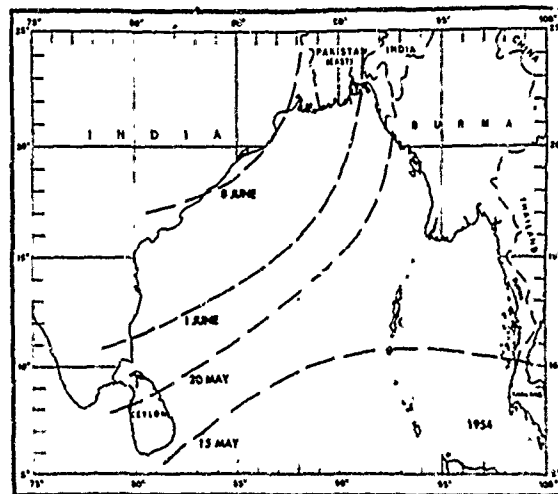
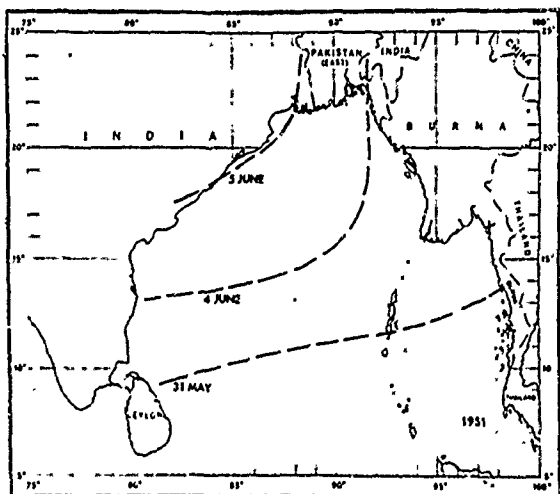
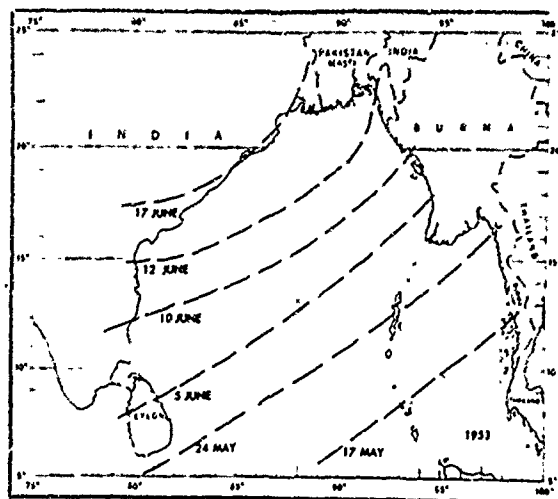
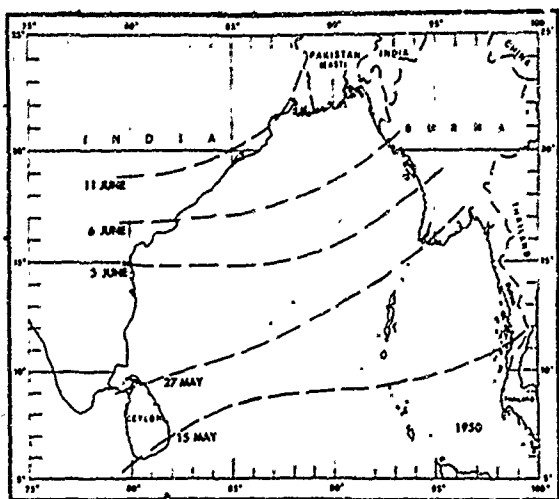


The tropical maritime air moving northward into India in summer is a deep current which has crossed several thousand miles of tropical sea and consequently is highly charged with water vapor. It advances rapidly northward over India as a definite front, its arrival being designated as the "burst of the monsoon." With the "burst" comes a complete change in the face of the weather, for heavy, squally rains accompanied by thunder and lightning ordinarily herald the arrival of the monsoon. In Farther India* the northward advance of the monsoon is less abrupt and is accompanied by less severe weather disturbances. Weather is less turbulent during the height of the monsoon (although rainfall is greater) than during the advance and retreat of the monsoon at the beginning and end of summer. The retreat of the monsoon is often accompanied by hurricane types of storms.

(Page 98, An Introduction to Climate, Glenn T. Trewartha, 1954).

* east of India

Figure 1 Monsoonal wind patterns over the area in January and July



(CHAKRAVARTY, 1956)

Figure 2 The advance of the southwest monsoon during different years

The monsoons sharply affect the surface waters of the area, and wind, rain, and land drainage produce a dominant low-salinity surface layer. Thus, surface salinities in the Bay of Bengal and Andaman Sea are the lowest in the Indian Ocean, and salinities at the head of the bay show the greatest seasonal range of any body of water of comparable size.

In addition, salinity is the most diagnostic property in the identification of water masses which influence the Bay of Bengal in the south. As the bay is closed on the north by the Asian landmass, only water masses from the Arabian Sea, Persian Gulf, and Red Sea to the west and Indian Intermediate Water from the south can enter the area (Figure 3).

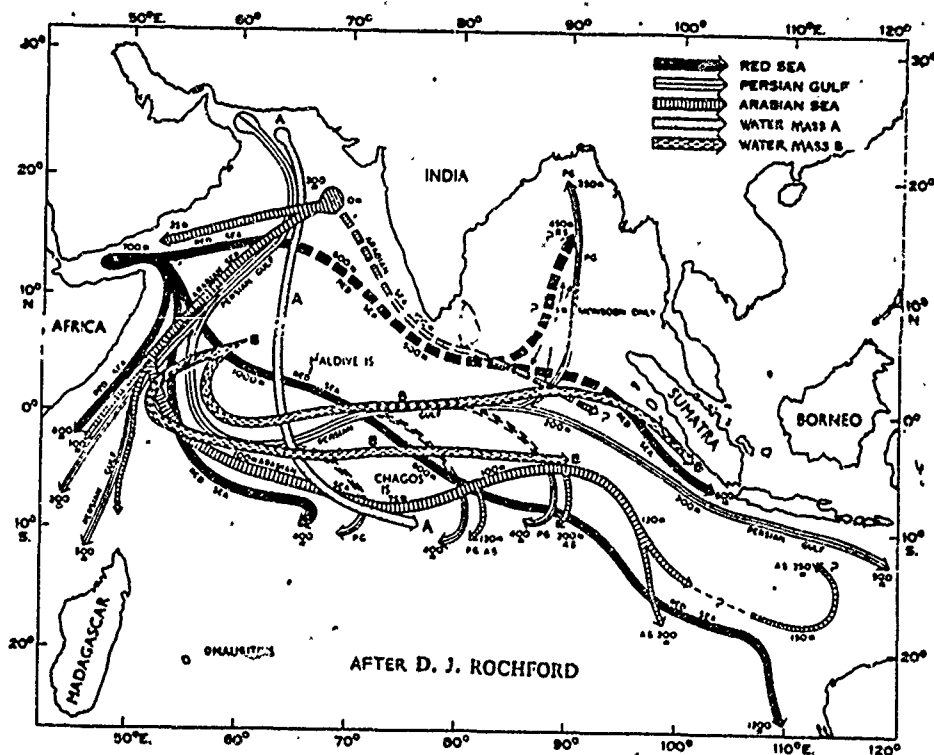


Figure 3 Schematic diagram showing distribution and original water masses in the Indian Ocean

Temperature values in the area, while high, are fairly conservative in seasonal range, reflecting in their variation the solar migration and in their distribution the monsoonal currents.

As density is dependent on temperature and salinity, its fluctuations reflect the larger variation of salinity.

Toward the end of the northeast monsoon, the surface waters in the Bay of Bengal and Andaman Sea become warmer and more saline, reaching the year's maximums for both properties in May. As the southwest monsoon approaches the east coast of India, the warm, highly stratified surface layers cool, tumble, and thoroughly mix under the influence of the monsoonal winds and rains. Although heavy rains lower the surface salinity, the greatest effect of the monsoon initially is a deepening of the surface layer.

The greatest change in surface salinity occurs during the period of maximum river drainage toward the end of the southwest monsoon. This effect is most pronounced in the Bay of Bengal, where the salinity minimum occurs during September and October, and in the Andaman Sea, where it occurs during November and December (Figure 4).

The distribution of the low-salinity water at the head of the Bay of Bengal varies with the direction of the currents. If the circulation at the head of the Bay is clockwise (during northeast monsoon), the water is transported as far east as the Andaman Sea; conversely if the circulation is counterclockwise (during southwest monsoon), this low-salinity water flows westward toward the east coast of India. The extremely shallow pass at Adams Bridge at the southern portion of Palk Strait blocks all water but the surface layer from entering the Gulf of Mannar.

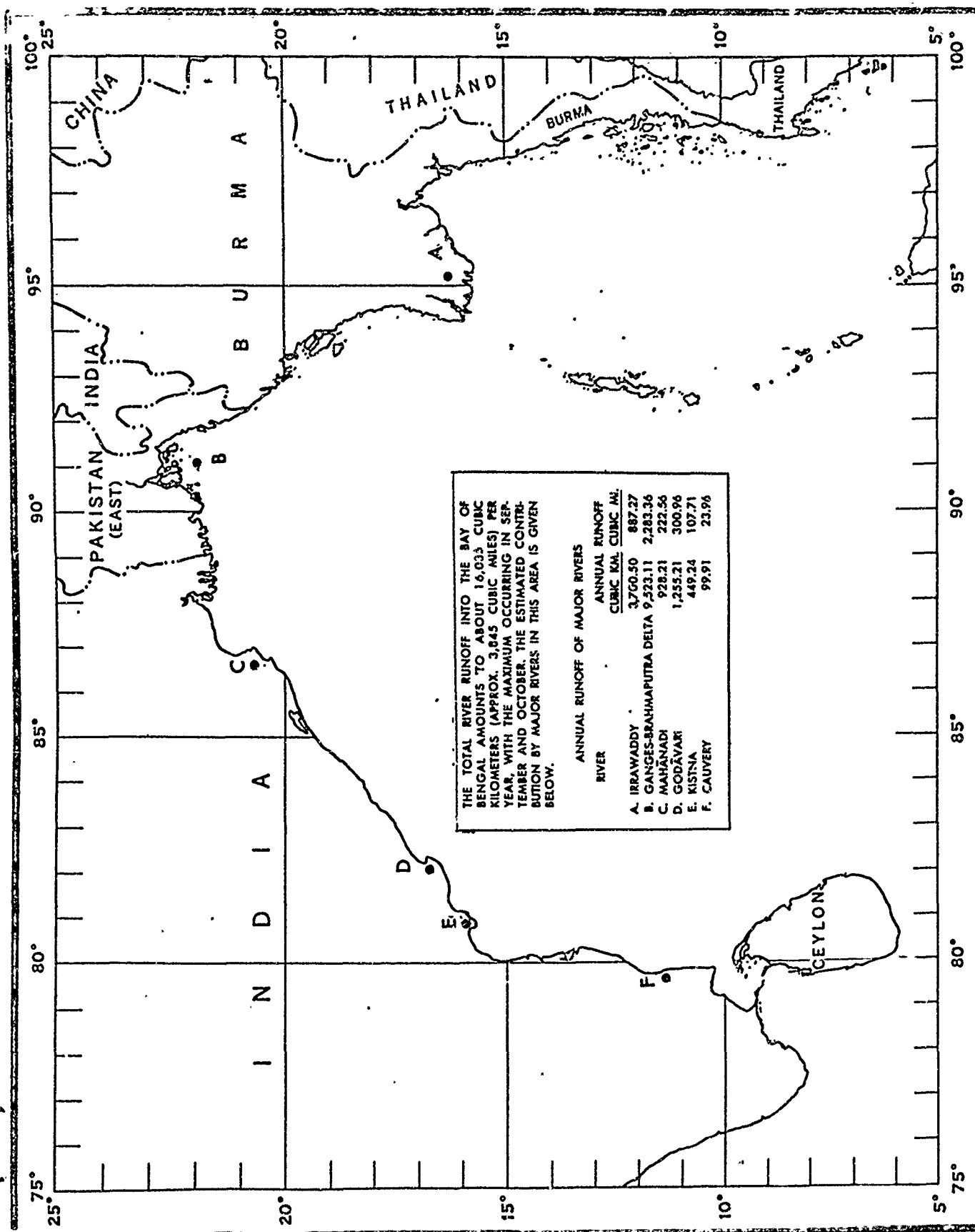


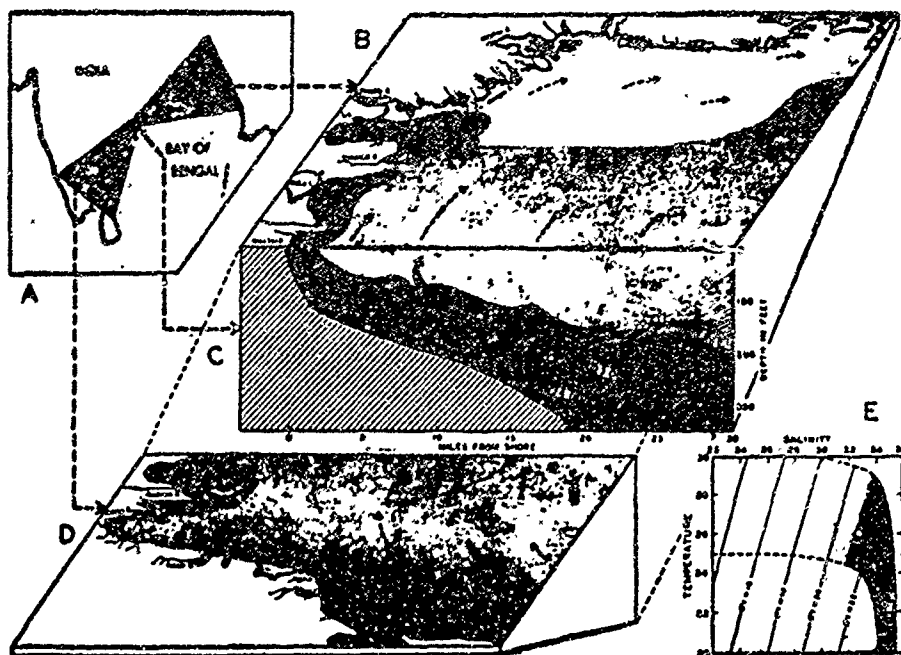
Figure 4 Annual runoff of major rivers

Upwelling in the first 100 meters (328 feet), a prominent feature of the northeast monsoon along the coasts of Burma and eastern India, ceases in May. During the end of the southwest monsoon sinking begins. While sinking continues until mid-November in these regions, upwelling occurs simultaneously in other parts of the area, such as along the coasts of the Malay Peninsula and southwestern India (Figure 5).

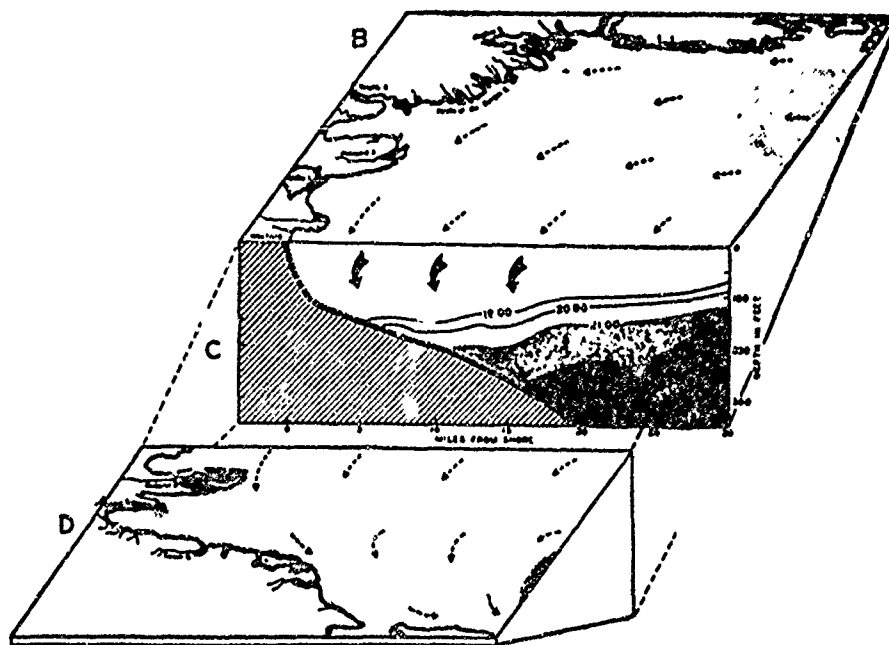
a. Temperature -- Temperature values in the area are relatively high and constant. The seasonal changes in sea surface temperature result from the high altitude passages of the sun and the changing cloud cover associated with the monsoons. Thus, the sea surface temperature in the bay and sea attains a maximum in April and May, when the sun is moving northward and the skies are cloudless, and a lesser maximum in September and October, when the sun is returning southward and the southwest monsoon is retreating. The annual minimum sea surface temperature in the bay and sea is usually observed in January. It is particularly evident at the head of the Bay of Bengal, where the mean sea surface temperature is as low as 23°C. (73.4°F.).

Local minimums caused by upwelling also may be detected at the surface, as for example along the east coast of India during March (Figure 5).

In general, the annual range of temperature in the area is small, even at the surface. It is smallest south of the Bay of Bengal and greatest at the bay's head. The average diurnal range of temperature is also small. For example, near Waltair, India it is only 1.4°C. (2.5°F.) in January and 2.8°C. (5.0°F.) in May.



Water masses (density distribution) off the East Coast of India in March.
 A. Areas used for projection. B. Sea surface north-east of Waltair. C. Vertical section off Waltair. D. Sea surface south-east of Waltair. E. T-S relations used for water masses.



Water masses (density distribution) off the East Coast of India in October.

Figure 5 Schematic diagram showing distribution and origin of water masses off east coast India in March and October (LaFond, 1954)

b. Salinity -- Salinity, the most variable property of sea water in the area, fluctuates over a wide range of values, both seasonally and geographically. For example, the lowest surface salinities in the entire Indian Ocean, with values considerably below 20‰, are observed near the mouths of the Irawaddy during the southwest monsoon. Similarly, the outflow of the Ganges dilutes the upper 45 meters (148 feet) of water in the Bay of Bengal as far away as 500 nautical miles from its mouth. An example of the variability of salinity may be found off the coast of Waltair. The change in mean salinity between August and November exceeds 7‰, while the actual change during a given period (1956-58) may be far different as seen in Figure 6.

Values exceeding 34‰ have been reported in the southern portion of the area. Locally, salinities of about 37‰ have been observed in the shallow waters near Sagar Island, India between April and June, a region where salinity is less than 20‰ in September and October.

Salinity in the area also varies diurnally; thus, off the coast of Waltair, the mean daily range is 0.41‰ in May and 1.52‰ in September. In general, the diurnal range of salinity is most variable during the period of lowest salinity.

Since salinity is the most variable property of water in the bay and sea, the major water masses can be easily detected from this element alone (Figure 3). Thus, Arabian Sea water which enters the bay from the west has a relatively high salinity of 35‰ and may be detected on both the surface and 100-meter (328-foot) charts (Figures 25 through 29 and 30 through 33, respectively). Modified water from the Red sea having a salinity slightly in excess of 35‰ appears between depths of 200 and 800 meters (656 to 2,625 feet) in the northern half of the area. It may be

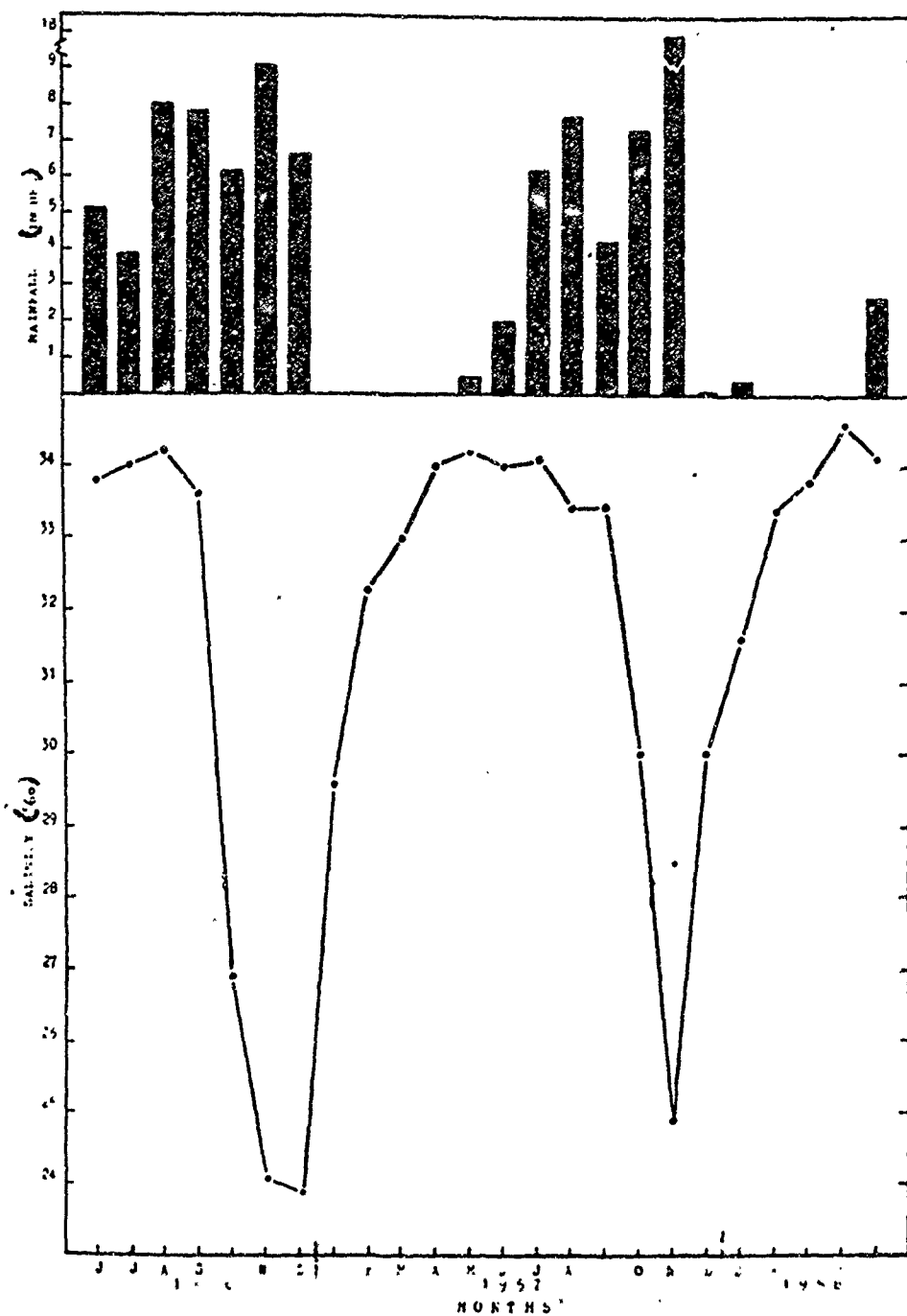


Figure 6 Seasonal fluctuations of rainfall and salinity off coast of Waltair during period June 1956 to May 1958

easily detected on the deep traces of salinity (Figures 63 through 65).

c. Density -- The density distribution in this area reflects its large salinity-induced variations. For example, at the head of the Bay of Bengal, density is relatively low and varies extensively throughout the year. Conversely, it is relatively high in the southern portion of the area where salinity is high and where surface density values may vary from 21.75 in February to greater than 22.00 in August.

DATA SOURCES

Except for surface temperature, few data on the physical properties of sea water are available in this area. A small percentage of the International Indian Ocean Expedition data was available at the time of publication of this study.

The values of sea surface temperature were tabulated from the punch-card decks of the Naval Oceanographic Office and U. S. Weather Bureau (Source 25). These surface data, which included observations made until 1960, were adequate over most of the area.

The horizontal distributions of temperature below the surface, which were increasingly deficient with depth, were obtained from Sources 22 and 23.

The vertical gradients of temperature were calculated from Sources 22 and 23, the frequency distribution of the isothermal layer depth from Source 23, and the surface variability of temperature from Source 25.

The surface distribution of salinity was determined from all available cruise data (Source 22), as well as from a number of scattered sources containing surface data only. Because of the wide variation of

surface salinity in this area, surface charts are presented for the months of February, April, June, August, and November.

The distribution of subsurface salinity was determined from Source 22. However, because of the inadequate data and the attenuation of seasonal variations at depth, the salinity observations at 100 meters (328 feet) were combined by trimonthly periods centered on February, May, August, and November. At 300 meters (981 feet) and 1,000 meters (3,281 feet), where seasonal effects have become negligible, all the available salinity data are combined regardless of month.

In this area the number of salinity observations was inadequate, particularly to the north of 7°N. during the period July through September. Below the surface, the data consist of a few widely scattered observations whose number decreases with depth. As a result, the isohalines in this study were generally estimated.

Although the density charts were derived from the same sources as salinity, their reliability was somewhat improved by combining the temperature and salinity analyses. The vertical gradients of salinity and density were computed from Source 22.

Additional information on the general physical properties of the water at the surface was obtained from Sources 6, 11, 20, and 21. Textual information on the overall distribution of temperature, salinity, and density in this area was collected from Sources 10, 14, 21, and 24.

Specific details for portions of the area were gleaned from Sources 3, 7, and 16 for the Gulf of Mannar and Palk Bay; Source 18 for the Strait of Malacca; Sources 13 and 17 for the coast off Waltair; Sources 1, 8, 12, and 15 for the waters off Cochin; and Sources 4, 9, 11, 13, and 19 for the east coast of India. Data on river drainage in this area were extracted from Source 5.

In addition to these reliable sources, all of which provided adequate information on the area, numerous additional references were consulted.

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TEMPERATURE CONVERSION TABLE - °F. to °C.							
(°F.)	(°C.)	(°F.)	(°C.)	(°F.)	(°C.)	(°F.)	(°C.)
25	-2.2	45	7.2	62	16.7	79	26.1
29	-1.7	46	7.8	63	17.2	80	26.7
30	-1.1	47	8.3	64	17.8	81	27.2
31	-0.6	48	8.9	65	18.3	82	27.8
32	0.0	49	9.4	66	18.9	83	28.3
33	0.6	50	10.0	67	19.4	84	28.9
34	1.1	51	10.6	68	20.0	85	29.4
35	1.7	52	11.1	69	20.6	86	30.0
36	2.2	53	11.7	70	21.1	87	30.6
37	2.8	54	12.2	71	21.7	88	31.1
38	3.3	55	12.8	72	22.2	89	31.7
39	3.9	56	13.3	73	22.8	90	32.2
40	4.4	57	13.9	74	23.3	91	32.8
41	5.0	58	14.4	75	23.9	92	33.3
42	5.6	59	15.0	76	24.4	93	33.9
43	6.1	60	15.6	77	25.0	94	34.4
44	6.7	61	16.1	78	25.6	95	35.0

TEMPERATURE CONVERSION TABLE - °C. to °F.			
(°C.)	(°F.)	(°C.)	(°F.)
-2	28.4	17	62.6
-1	30.2	18	64.4
0	32.0	19	66.2
1	33.8	20	68.0
2	35.6	21	69.8
3	37.4	22	71.6
4	39.2	23	73.4
5	41.0	24	75.2
6	42.8	25	77.0
7	44.6	26	78.8
8	46.4	27	80.6
9	48.2	28	82.4
10	50.0	29	84.2
11	51.8	30	86.0
12	53.6	31	87.8
13	55.4	32	89.6
14	57.2	33	91.4
15	59.0	34	93.2
16	60.8	35	95.0

HORIZONTAL DISTRIBUTION OF TEMPERATURE (°F.)

Isotherms are presented in °F. In the vicinity of large rivers and coastal regions with heavy rainfall, temperature values may be subject to extensive short-term variations.

Because of the large number of observations available and the variability of surface waters, the mean sea surface temperature distribution is presented for all months in Figures 7 through 18. In addition, the monthly variability of sea surface temperature is graphed in Figures 19 and 20 for selected regions.

The mean temperature distribution at 100 meters (328 feet) is shown for trimonthly periods in Figures 21 through 24.

Conversion tables of Celsius (°C.) and Fahrenheit (°F.) are given on page 19 .

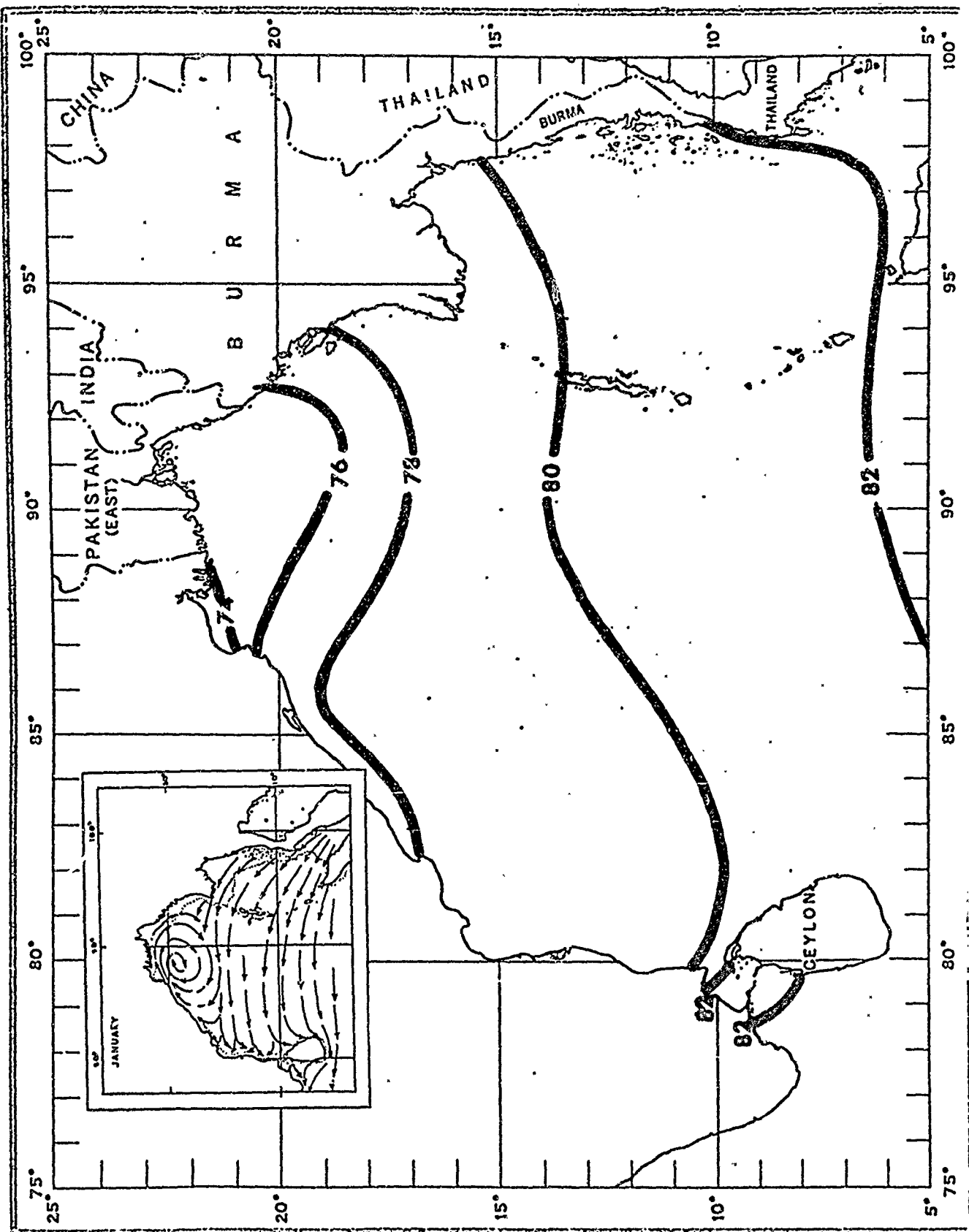


Figure 7 Mean sea surface temperature (°F.), January

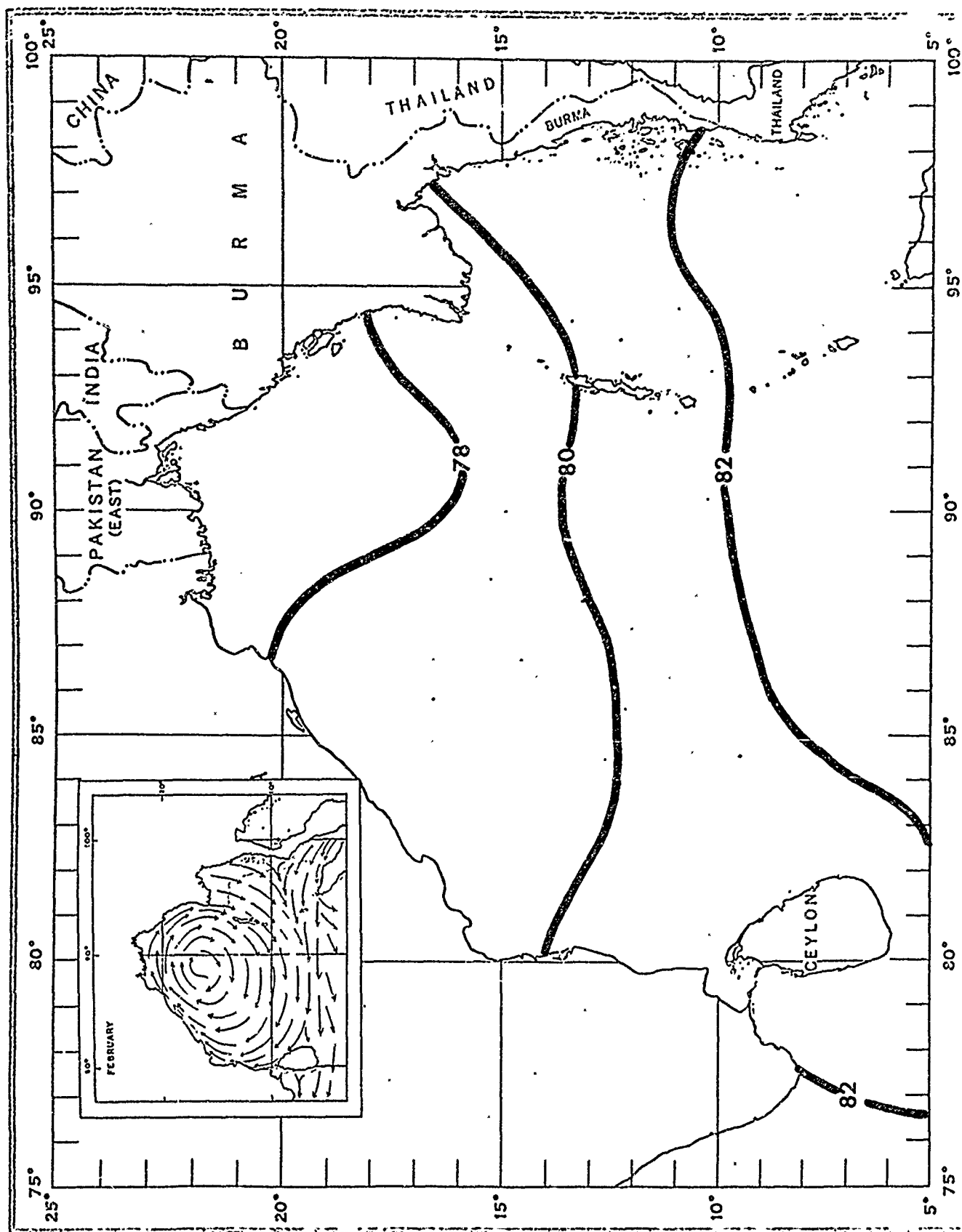


Figure 8 Mean sea surface temperature (°F.), February

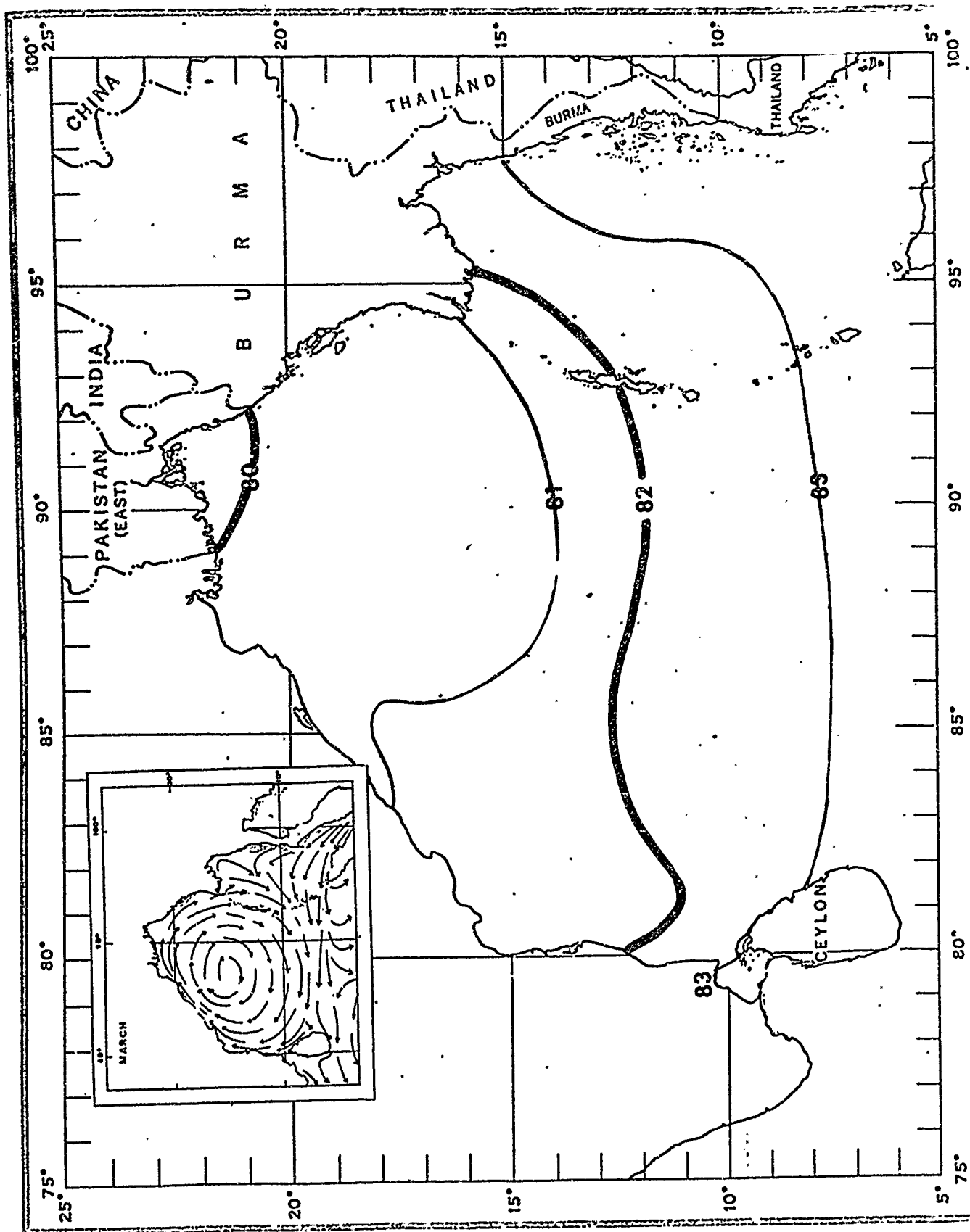


Figure 9 Mean sea surface temperature (°F.), March

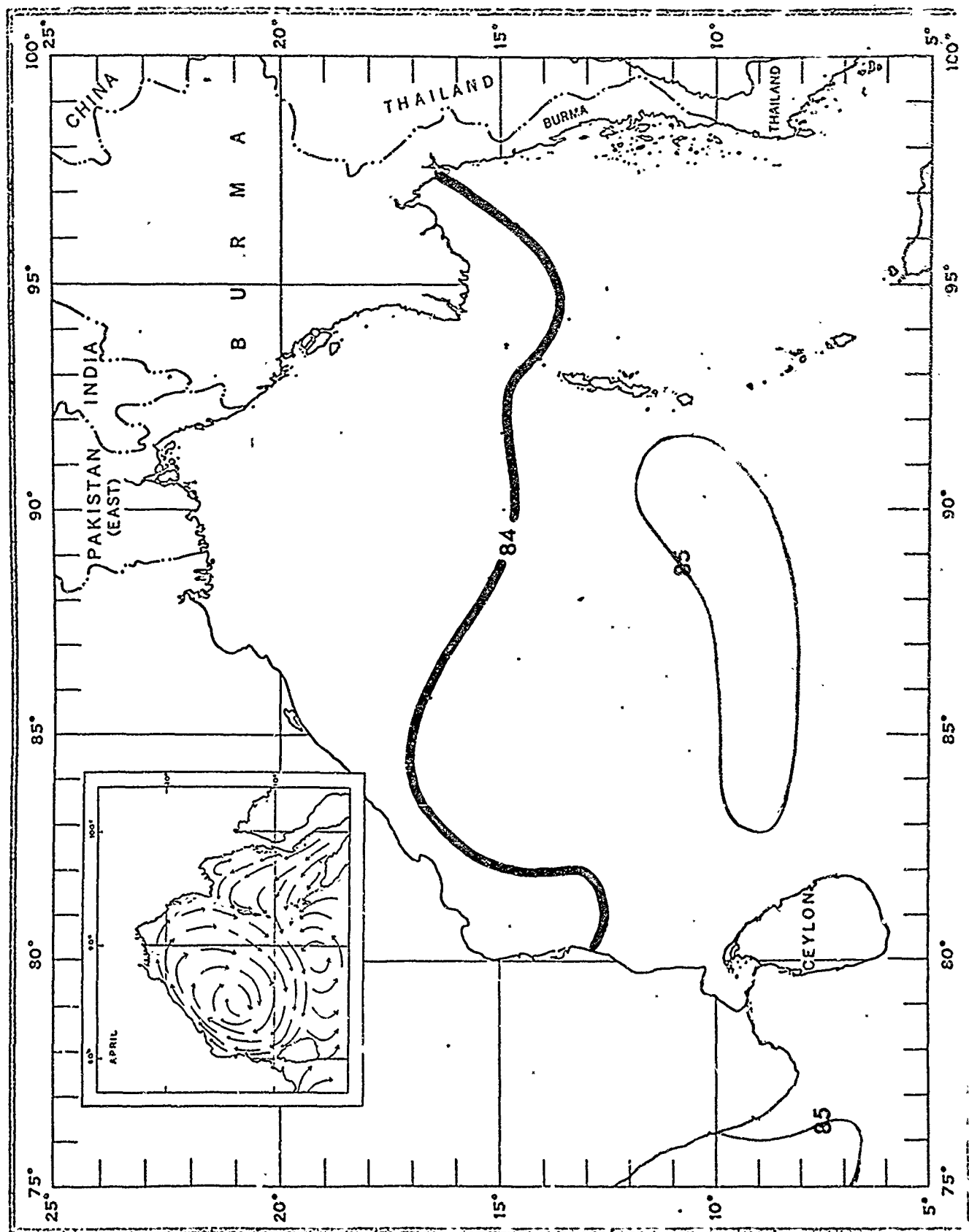


Figure 10 Mean sea surface temperature (°F.), April

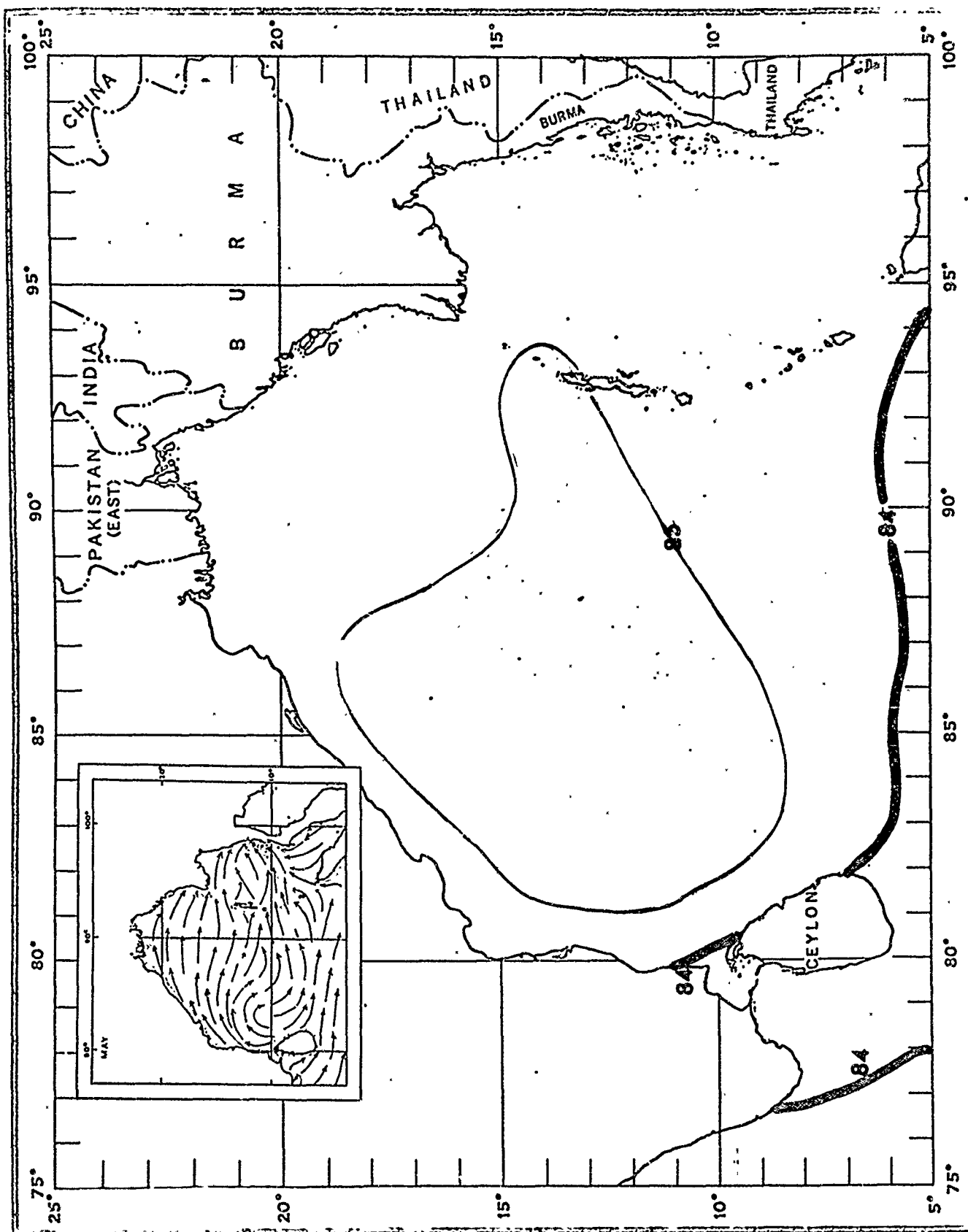


Figure 11 Mean sea surface temperature (°F.), May

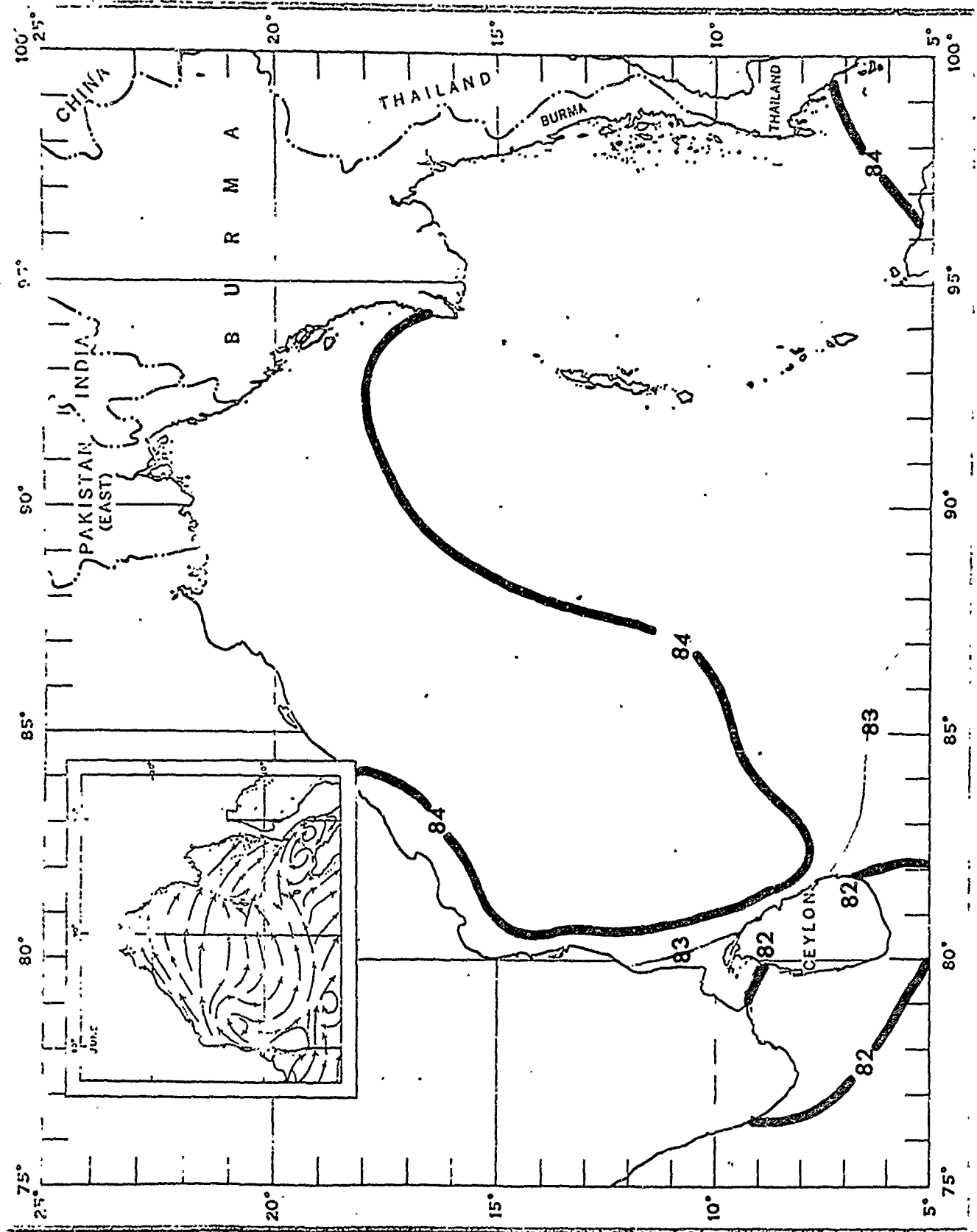


Figure 12 Mean sea surface temperature (°F.), June

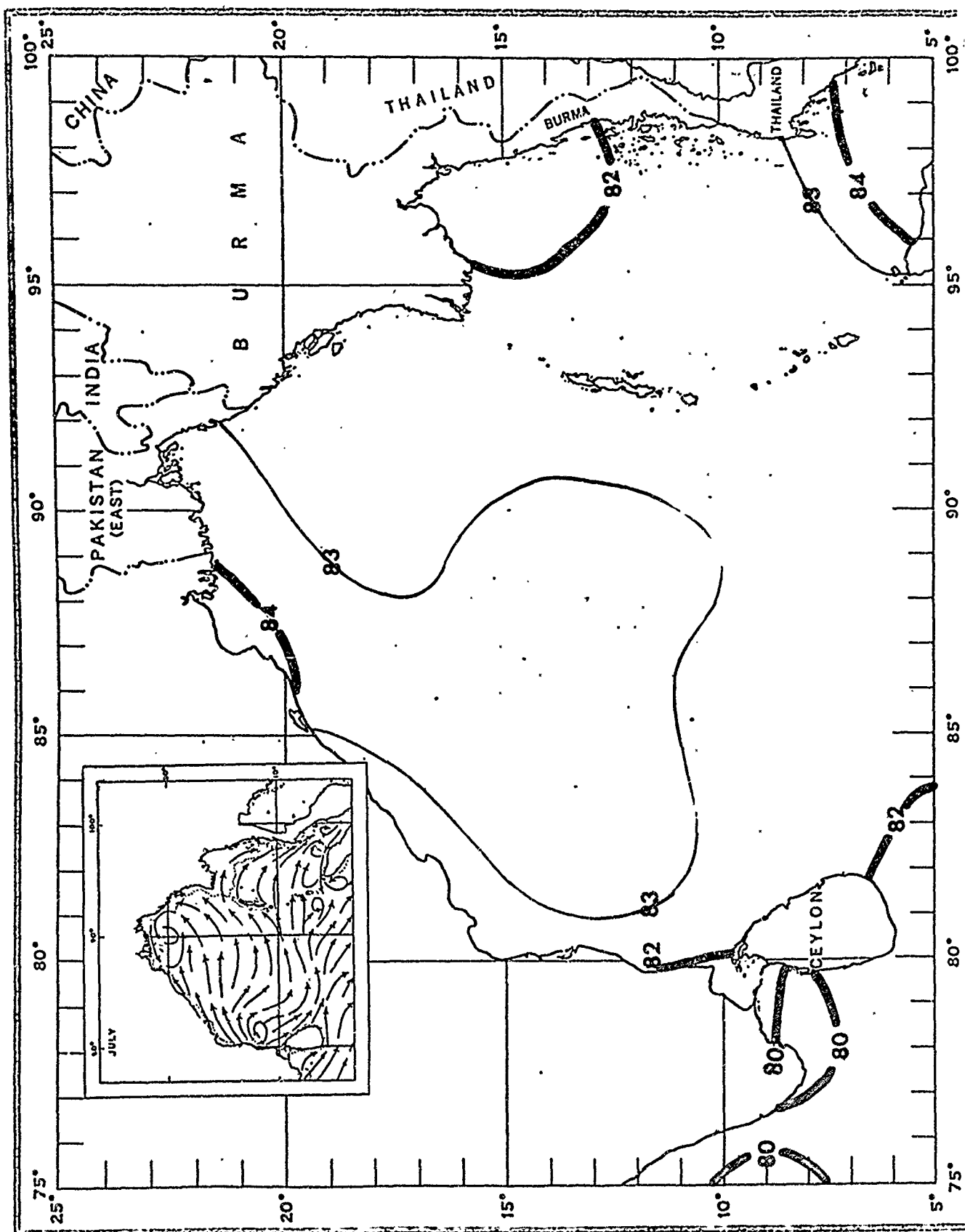


Figure 13 Mean sea surface temperature (°F.), July

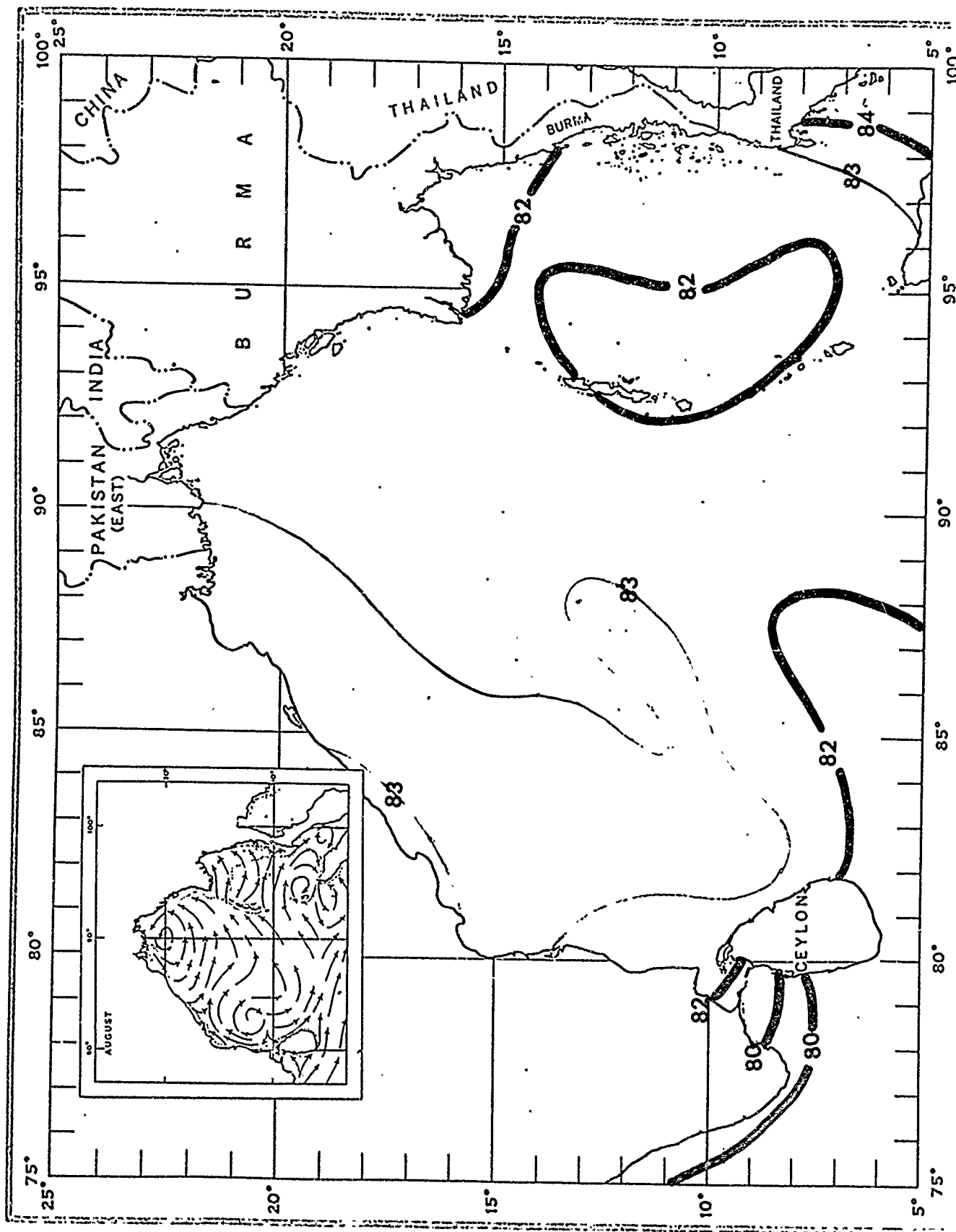


Figure 14 Mean sea surface temperature (°F.), August

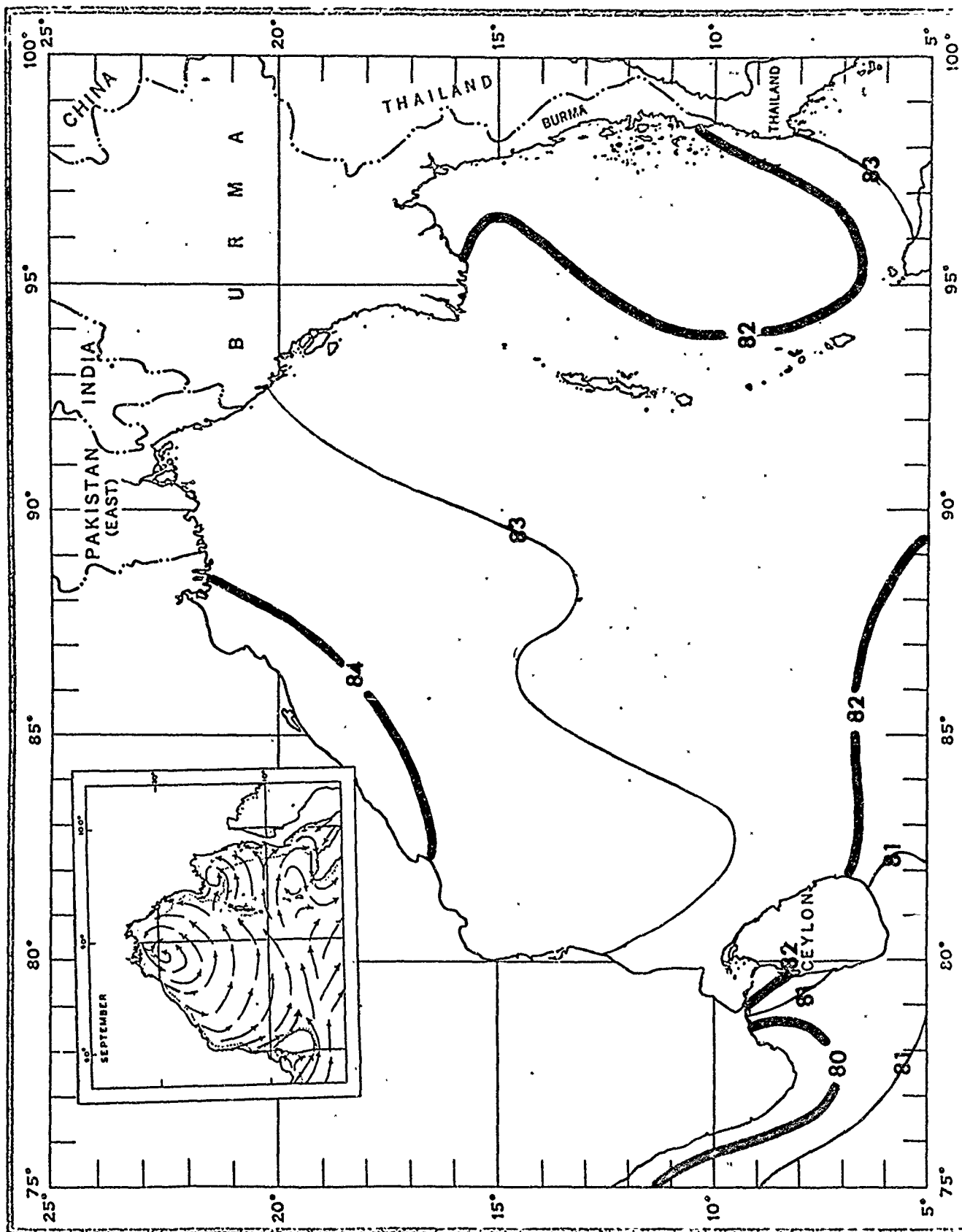


Figure 15 Mean sea surface temperature (°F.), September

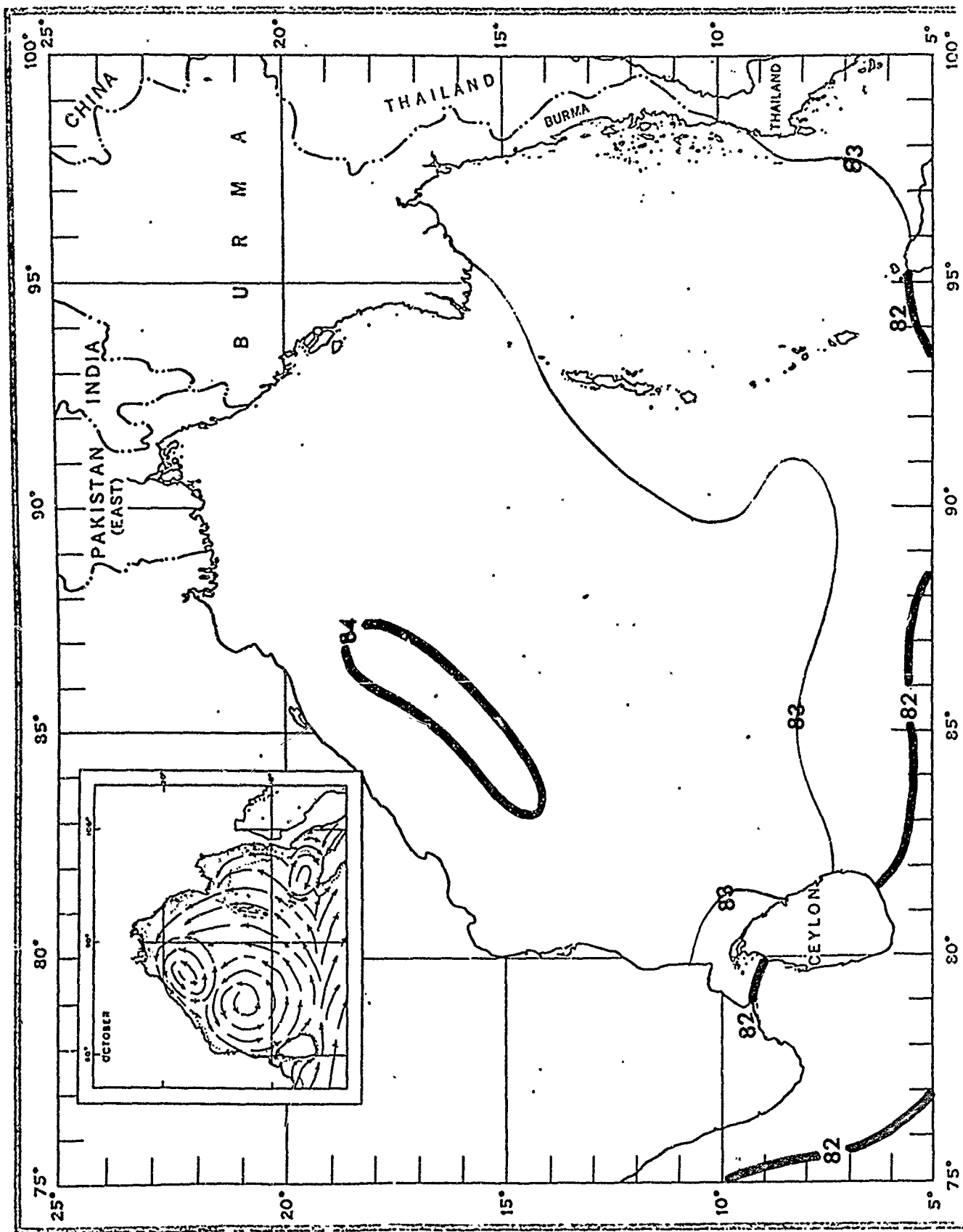


Figure 16 Mean sea surface temperature (°F.), October

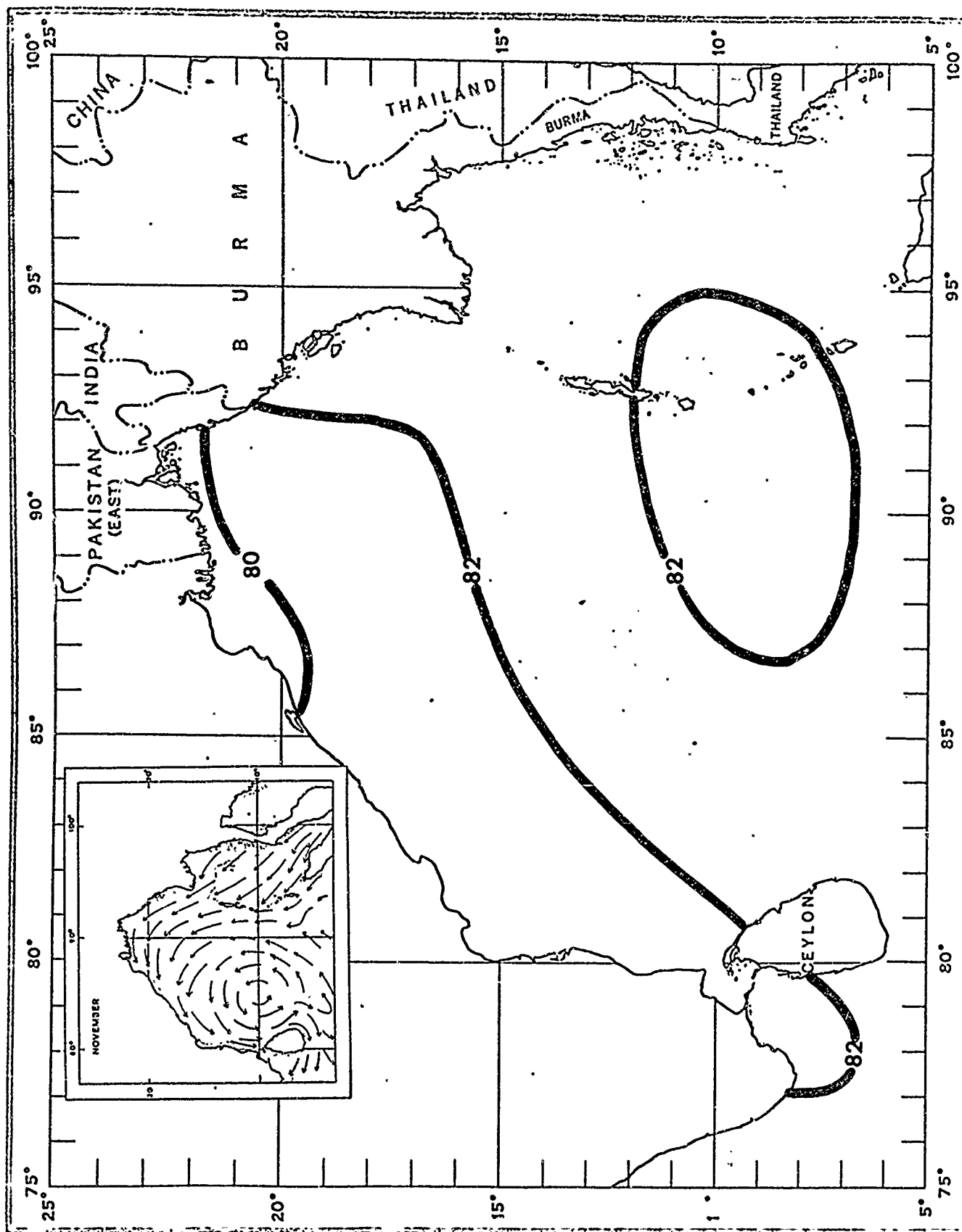


Figure 17 Mean sea surface temperature (°F.), November

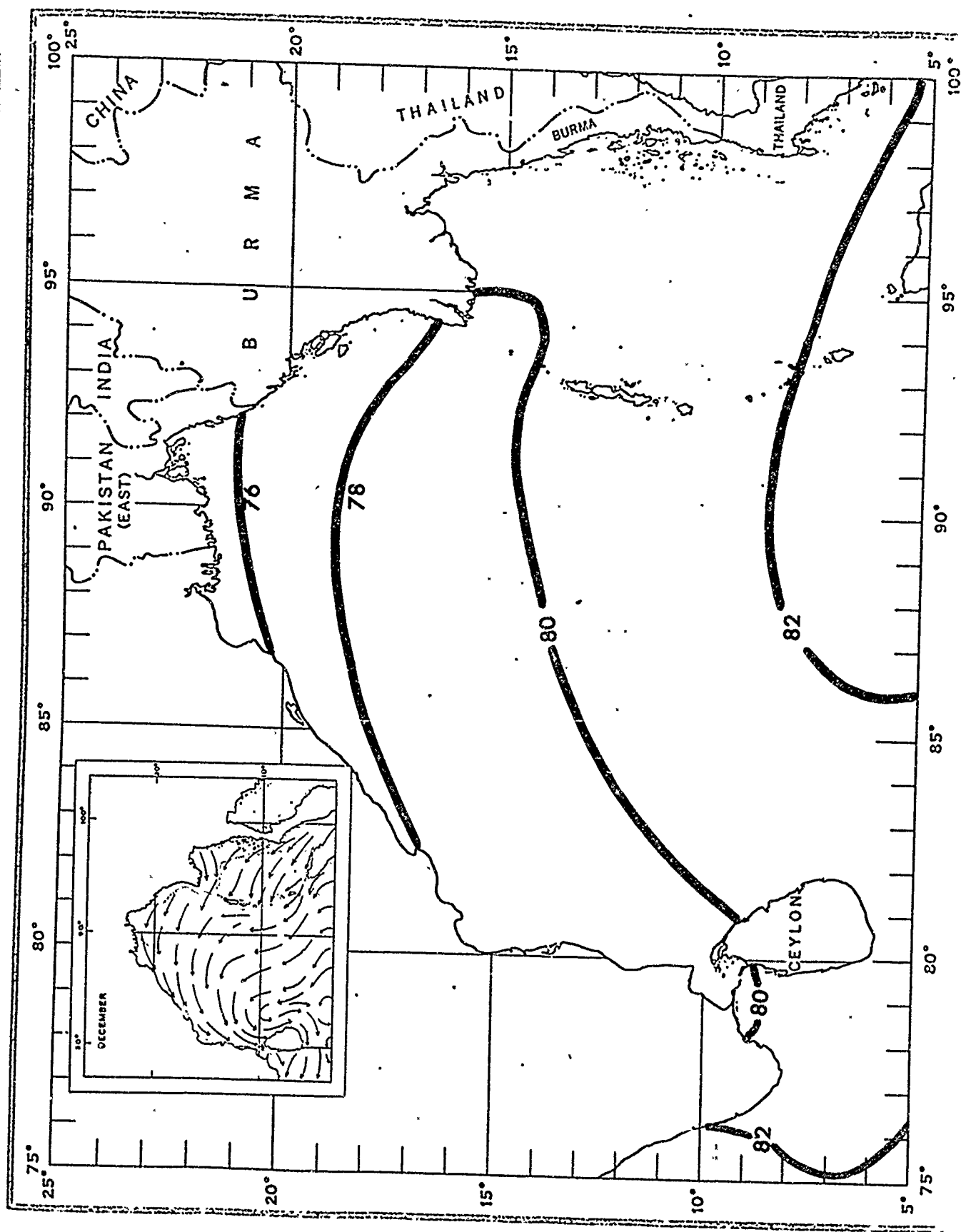


Figure 18 Mean sea surface temperature (°F.), December

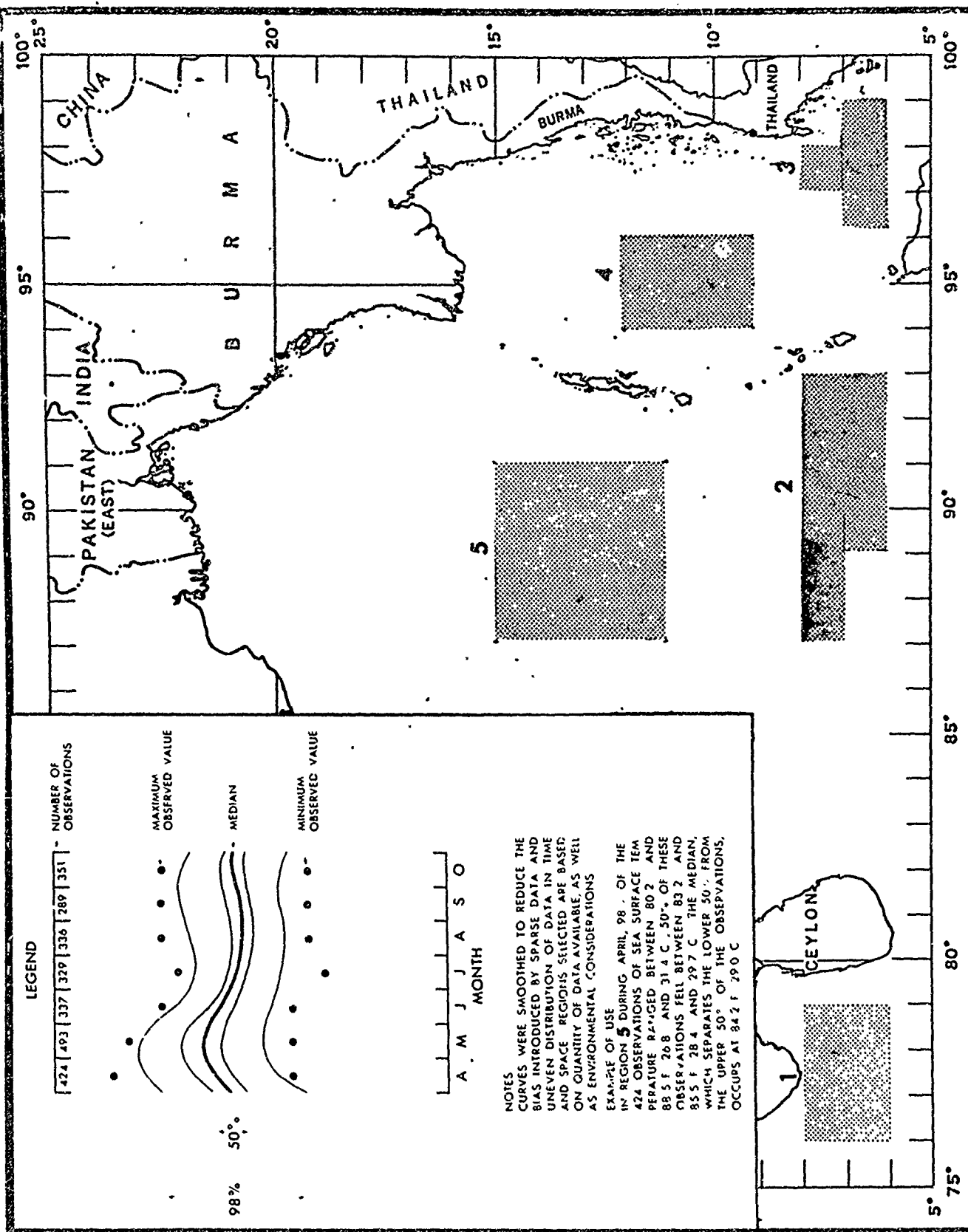


Figure 19 Monthly variability of sea surface temperature at selected locations - Locator chart

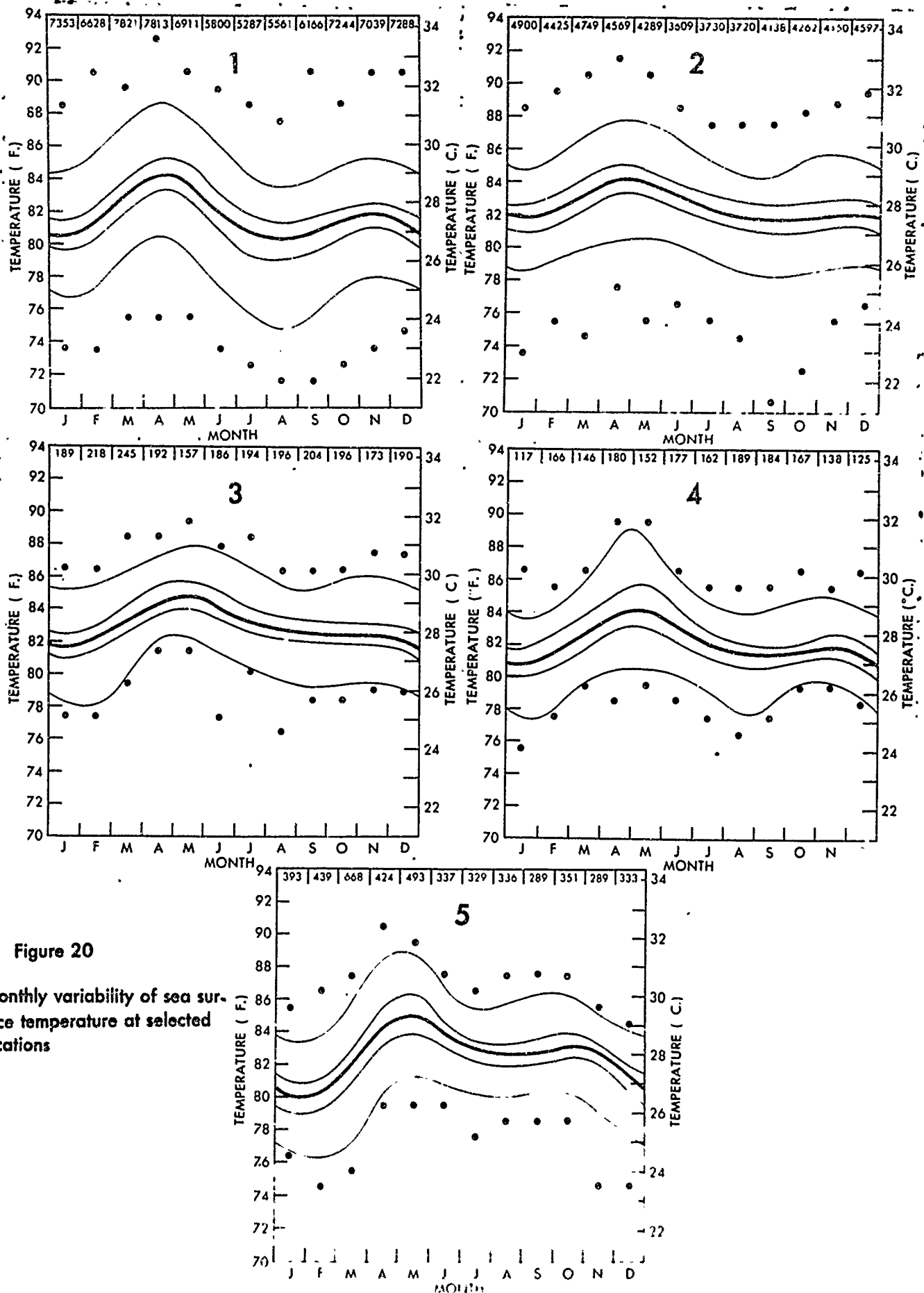


Figure 20

Monthly variability of sea surface temperature at selected locations

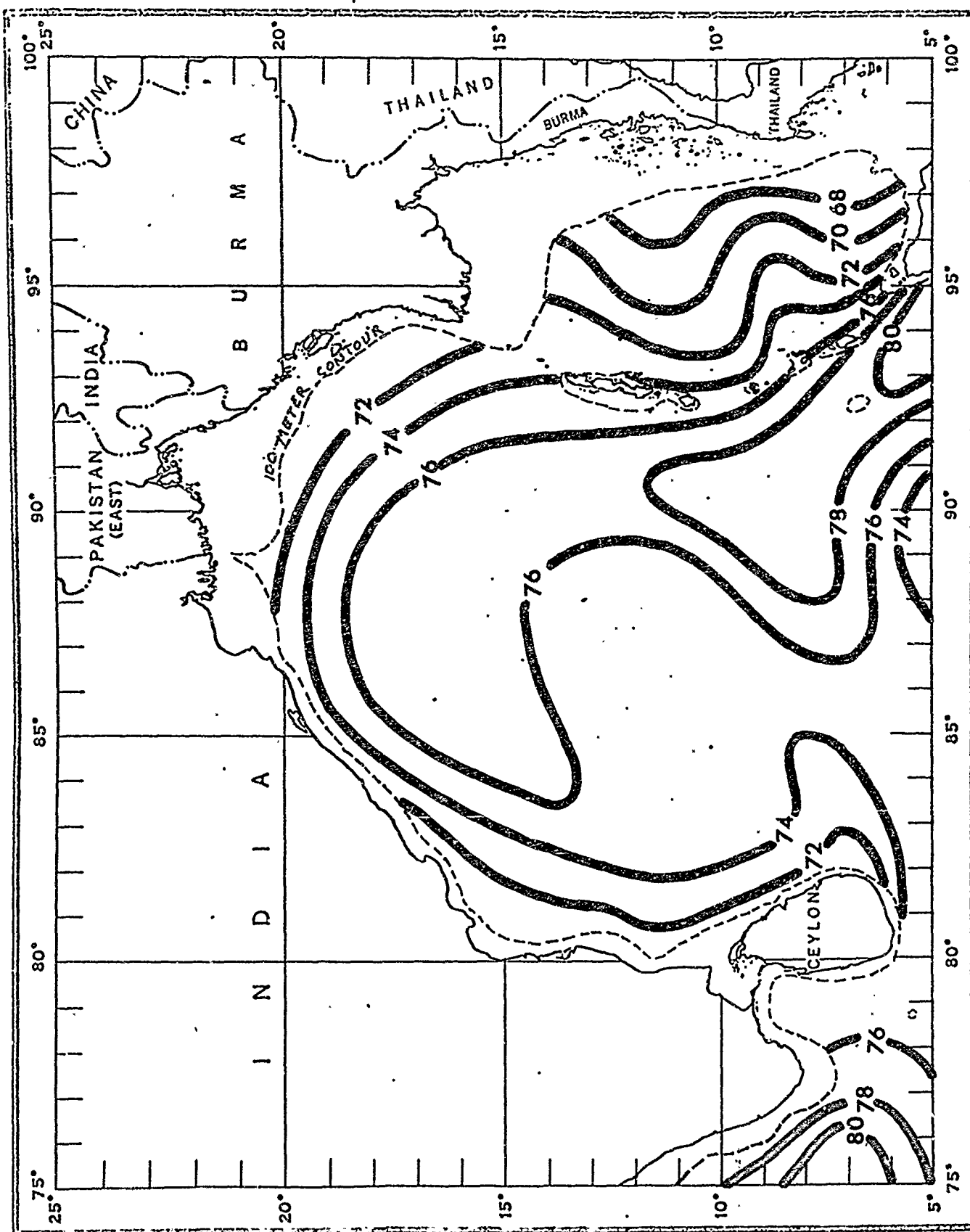


Figure 21 Mean temperature (°F.) at 100 meters (328 feet),
January through March

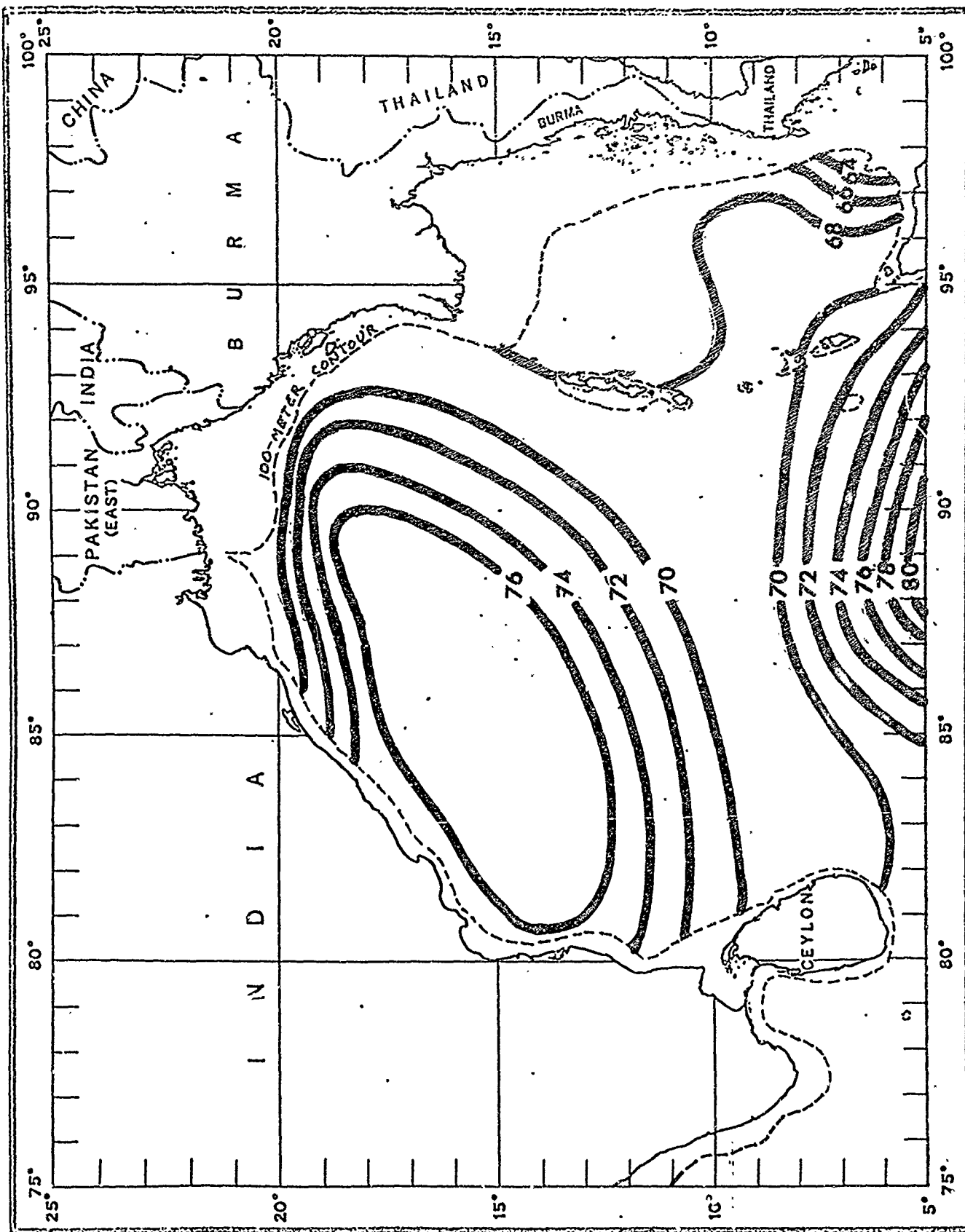


Figure 22 Mean temperature (°F.) at 100 meters (328 feet), April through June

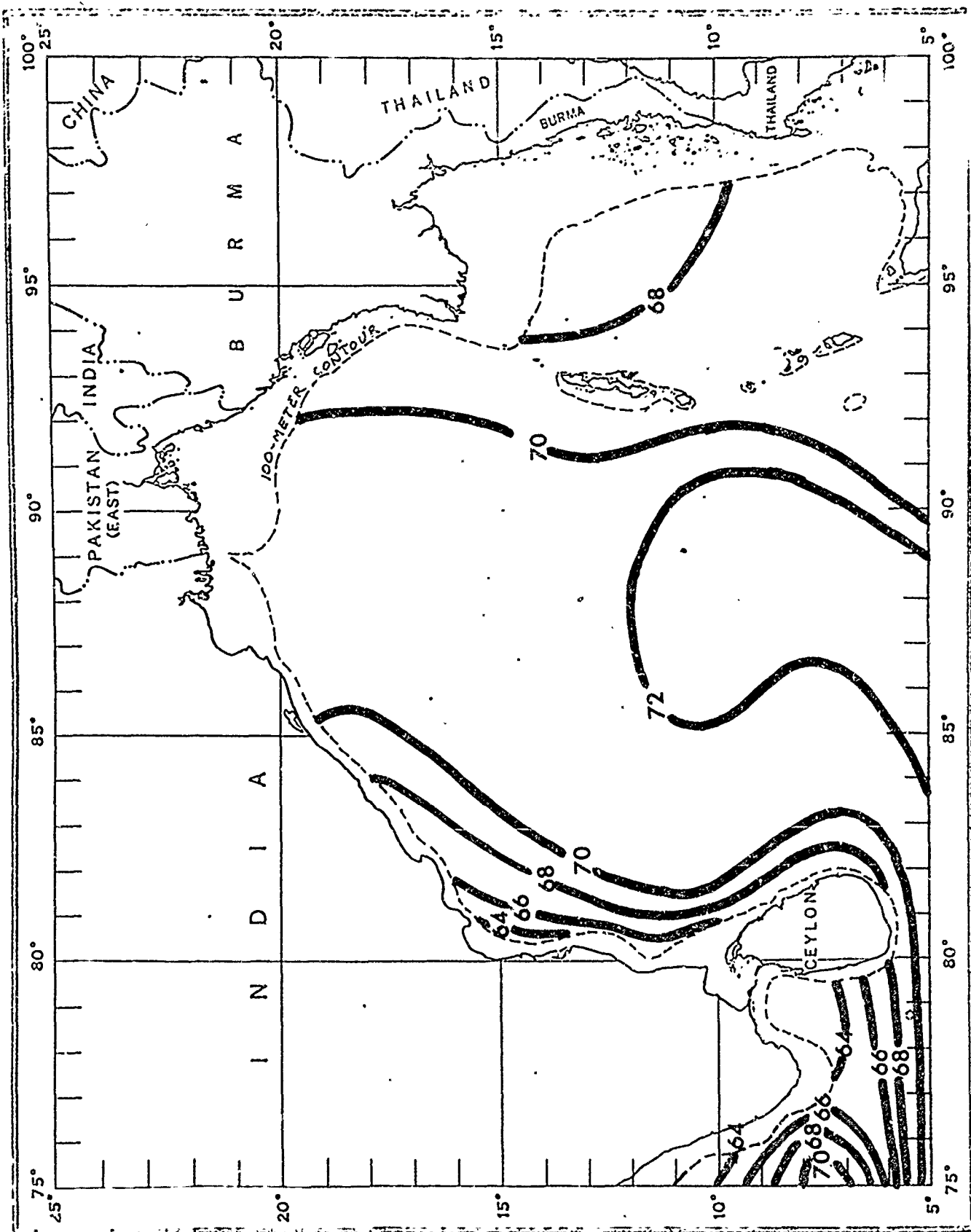


Figure 23 Mean temperature (°F.) at 100 meters (328 feet),
July through September

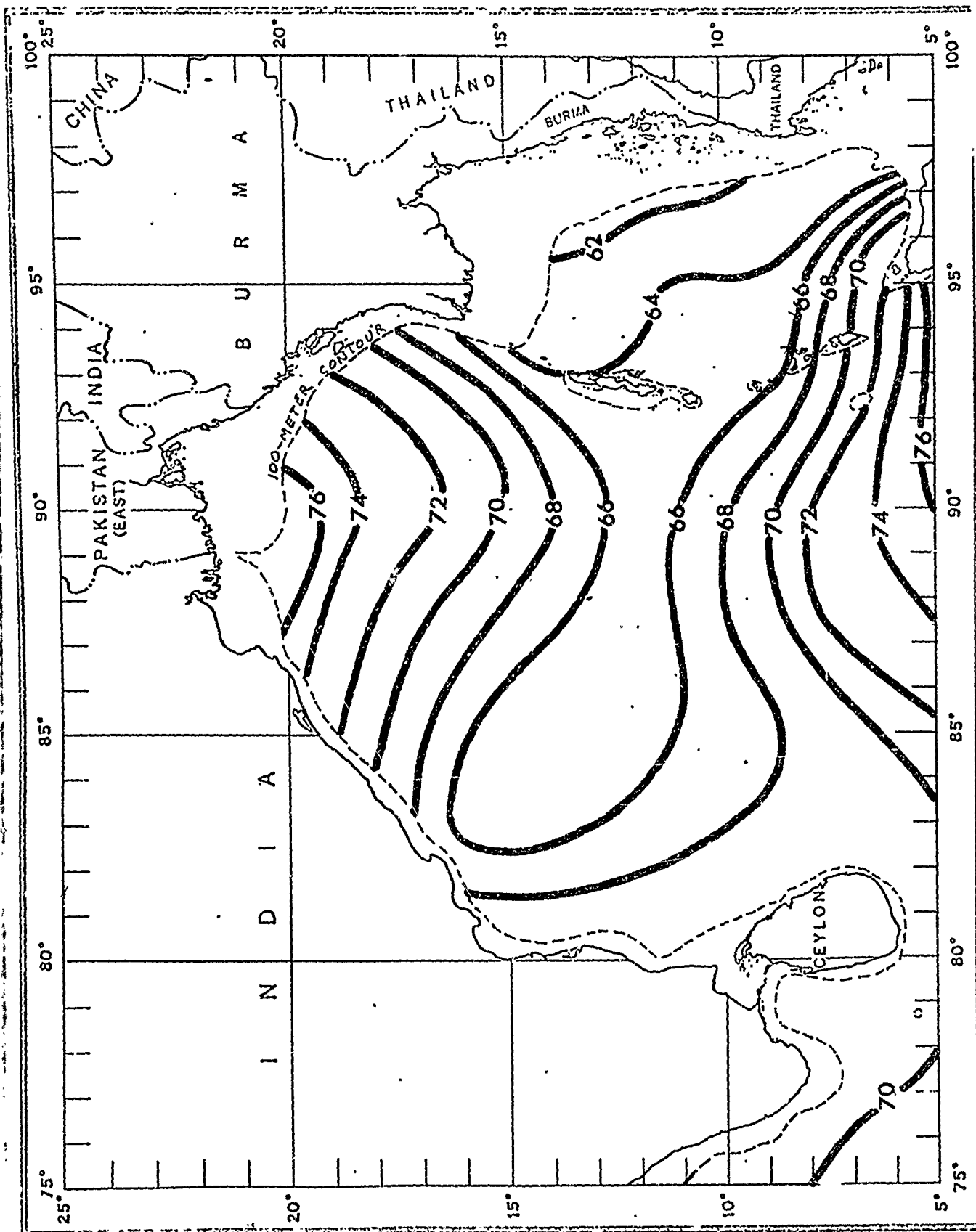


Figure 24 Mean temperature (°F.) at 100 meters (328 foot),
October through December

HORIZONTAL DISTRIBUTION OF SALINITY (‰)

Isosalines are presented in parts per thousand (‰). To show greater detail, intermediate values in increments of 0.25‰ are inserted (thin lines) wherever possible.

In the vicinity of large rivers and in coastal regions, salinity is subject to extensive short-term variations and may be much lower than the indicated offshore values.

Mean sea surface salinity is analyzed for February, April, June, August, and November in Figures 25 through 29, respectively.

The salinity distribution at 100 meters (328 feet) is presented by trimonthly periods in Figures 30 through 33.

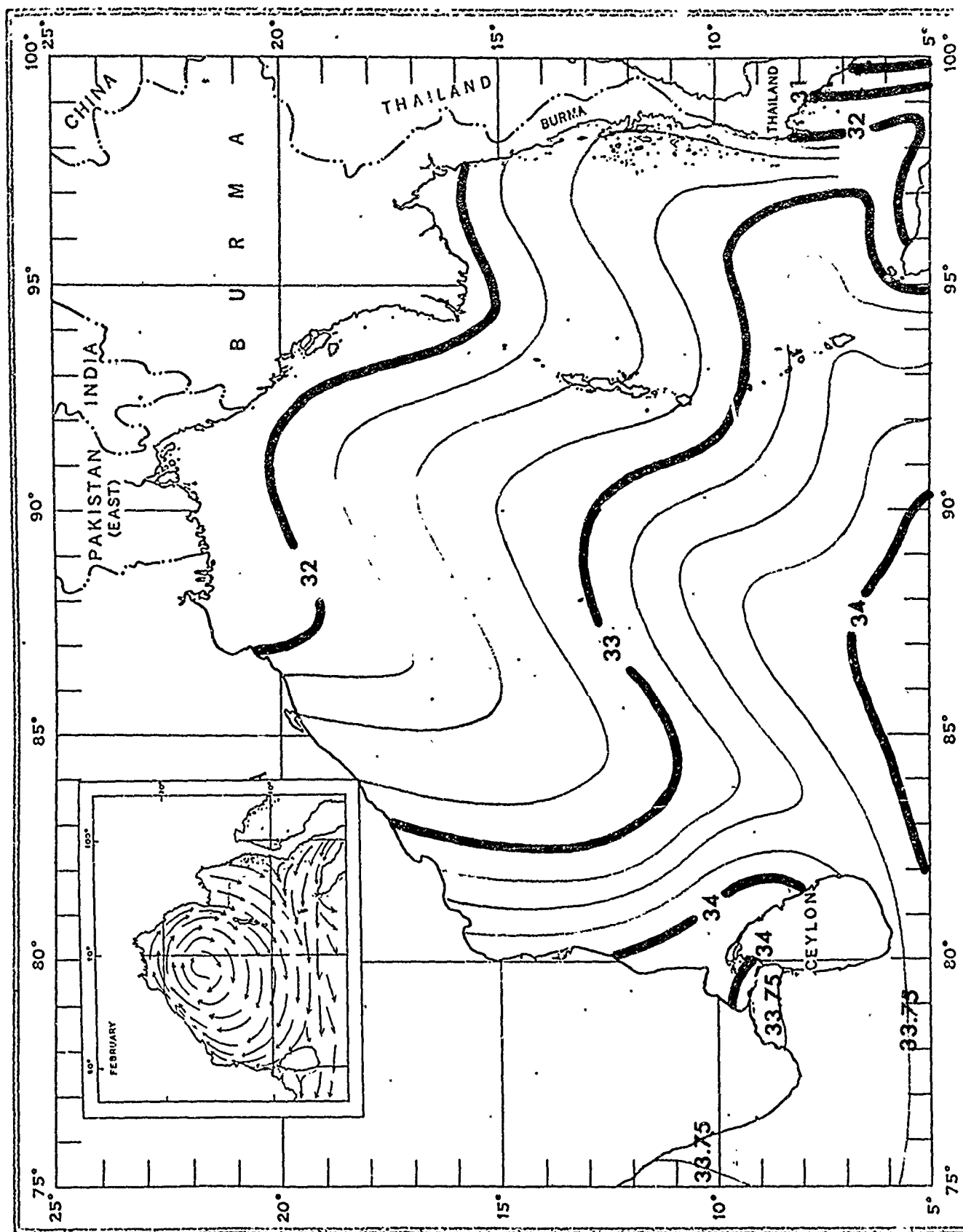


Figure 25 Mean sea surface salinity (parts per thousand),
February

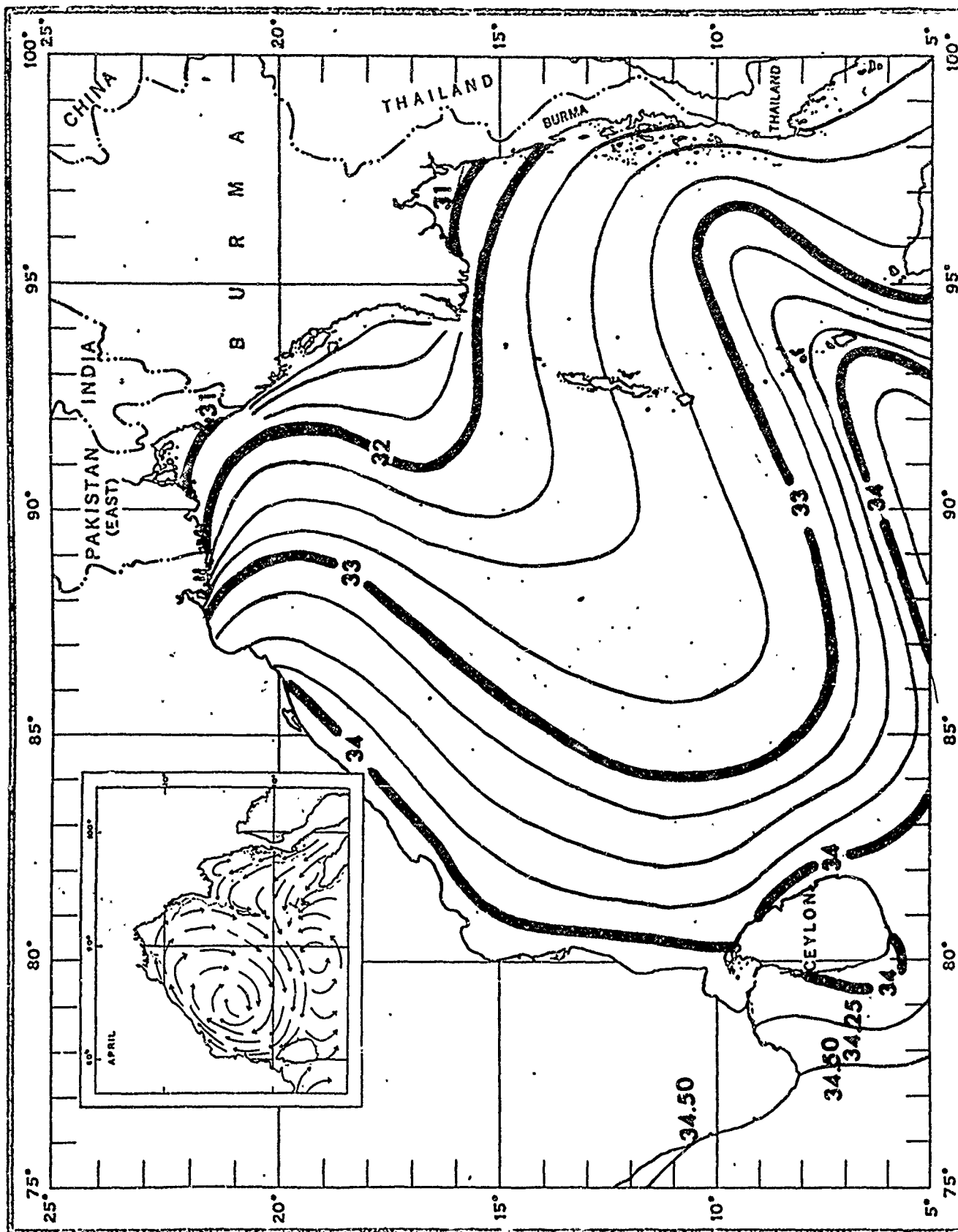


Figure 26 Mean sea surface salinity (parts per thousand),
April

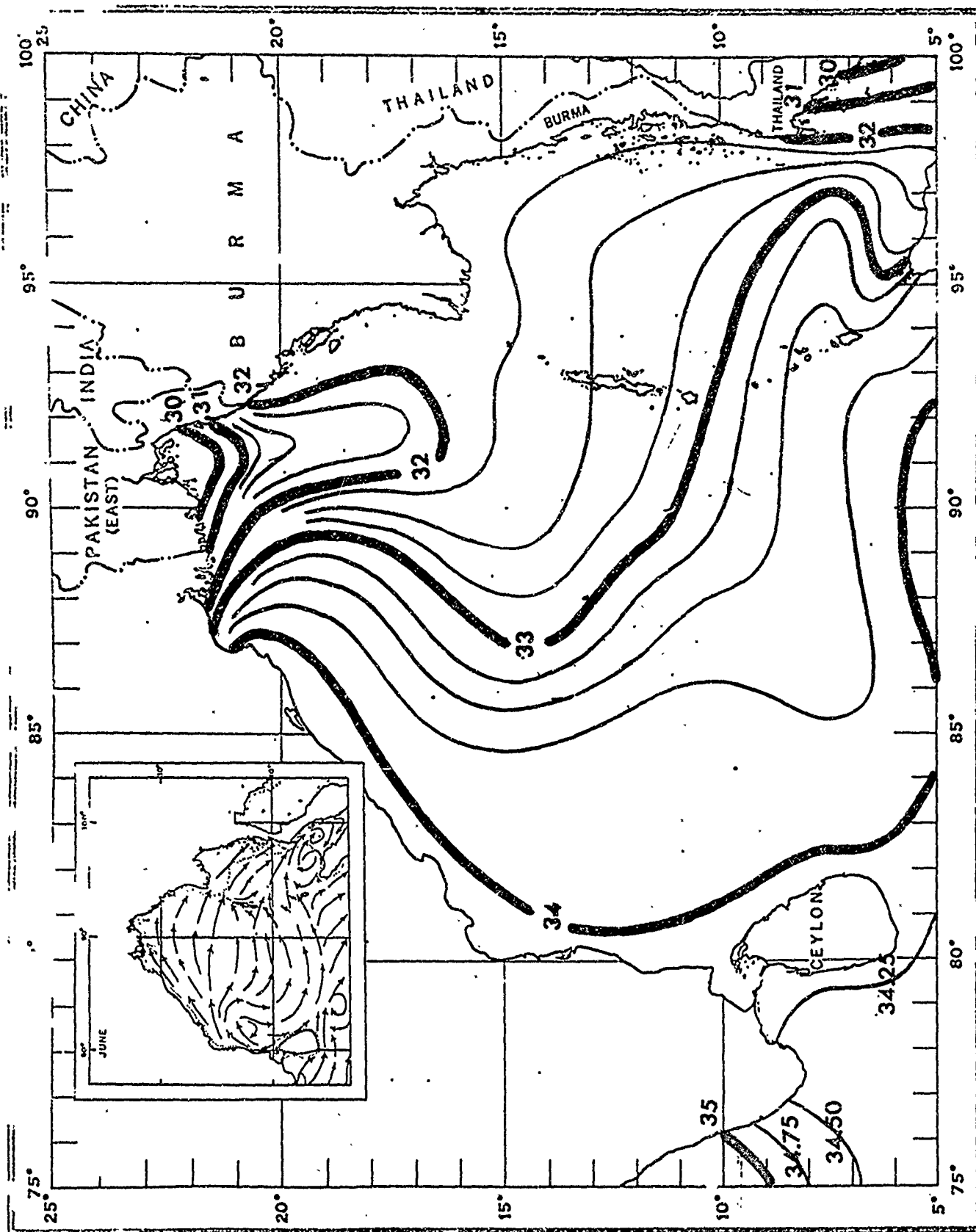


Figure 27 Mean sea surface salinity (parts per thousand), June

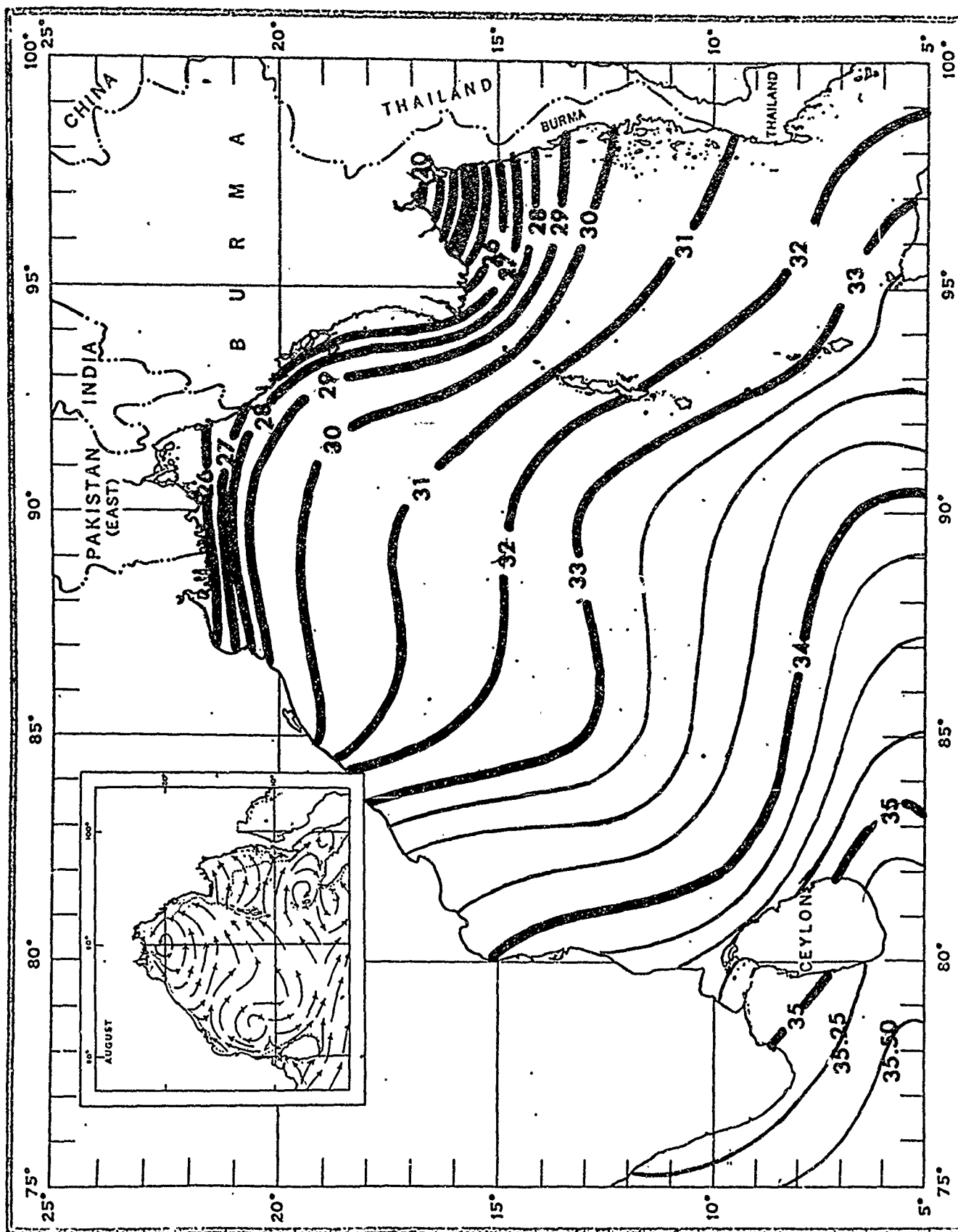


Figure 28 Mean sea surface salinity (parts per thousand), August

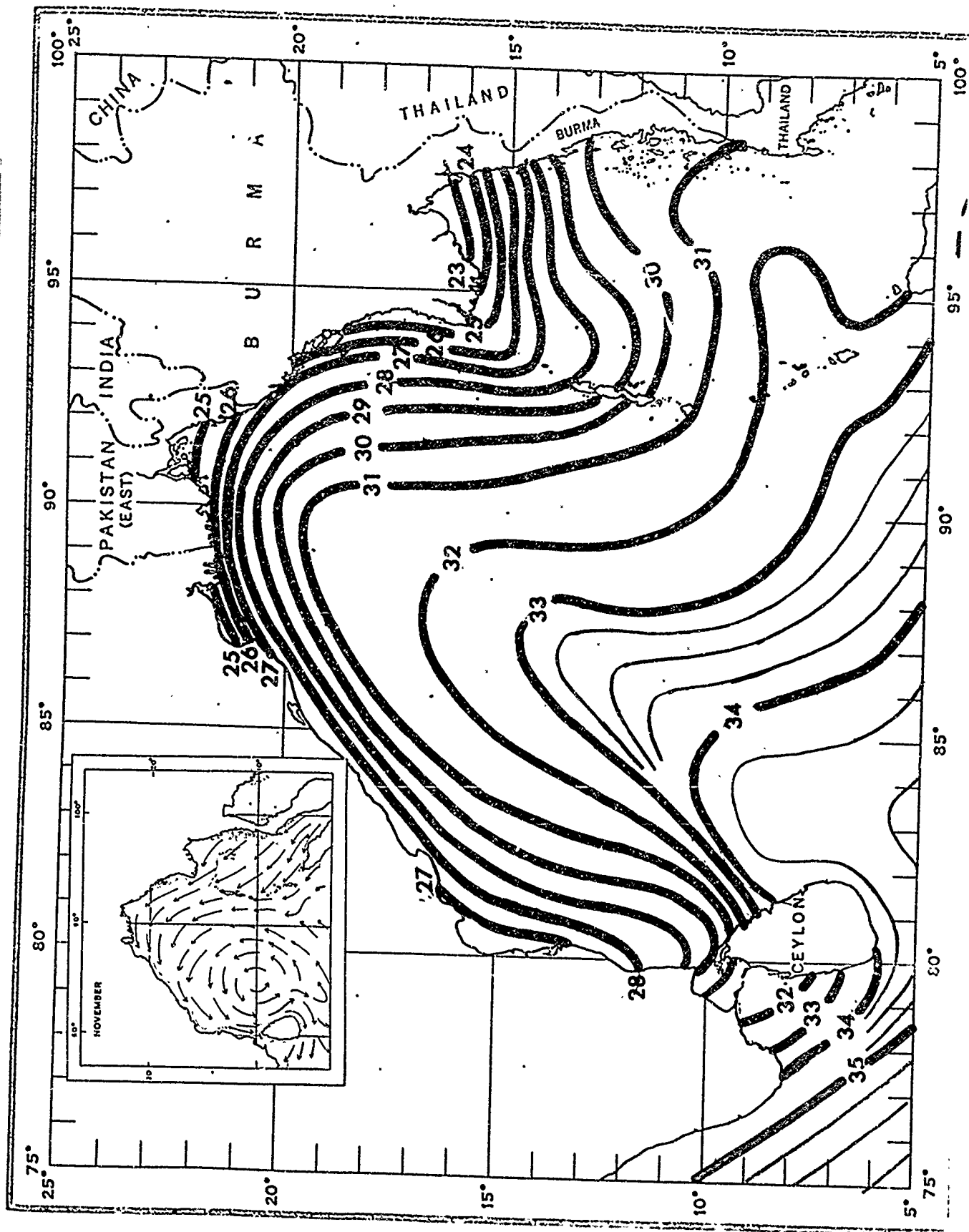


Figure 29 Mean sea surface salinity (parts per thousand), November

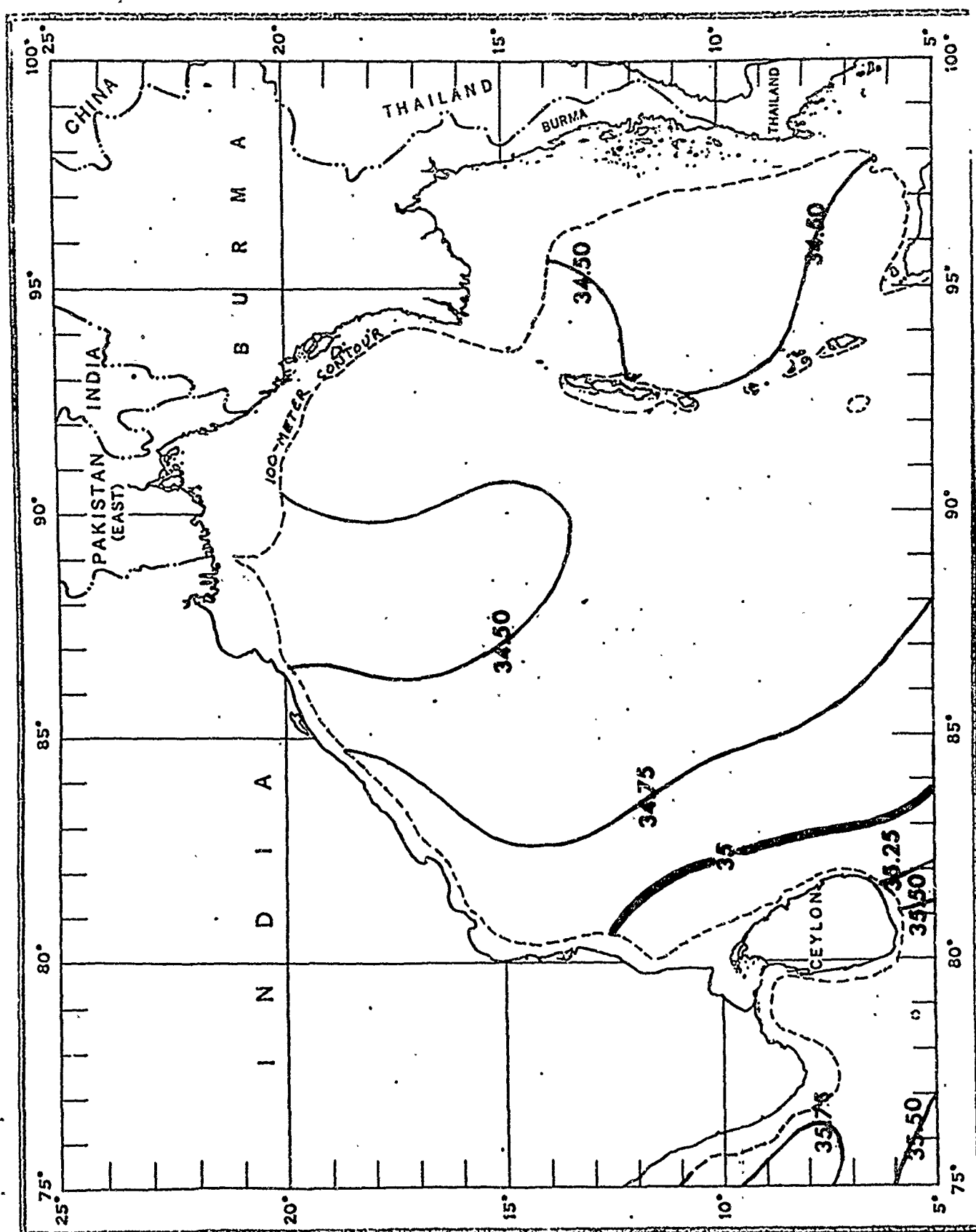


Figure 30 Mean salinity (parts per thousand) at 100 meters
(328 feet), January through March

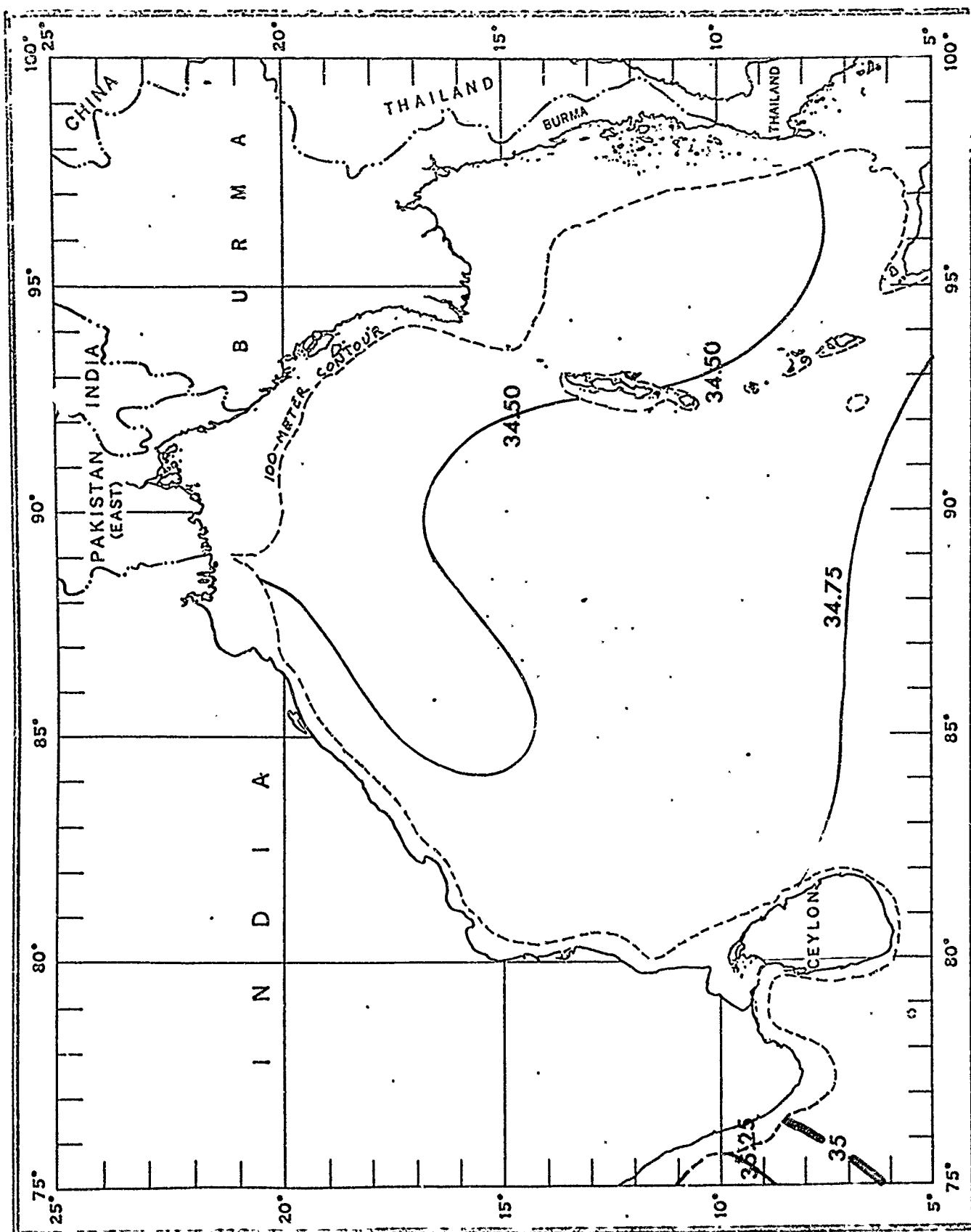


Figure 31 Mean salinity (parts per thousand) at 100 meters (328 feet), April through June

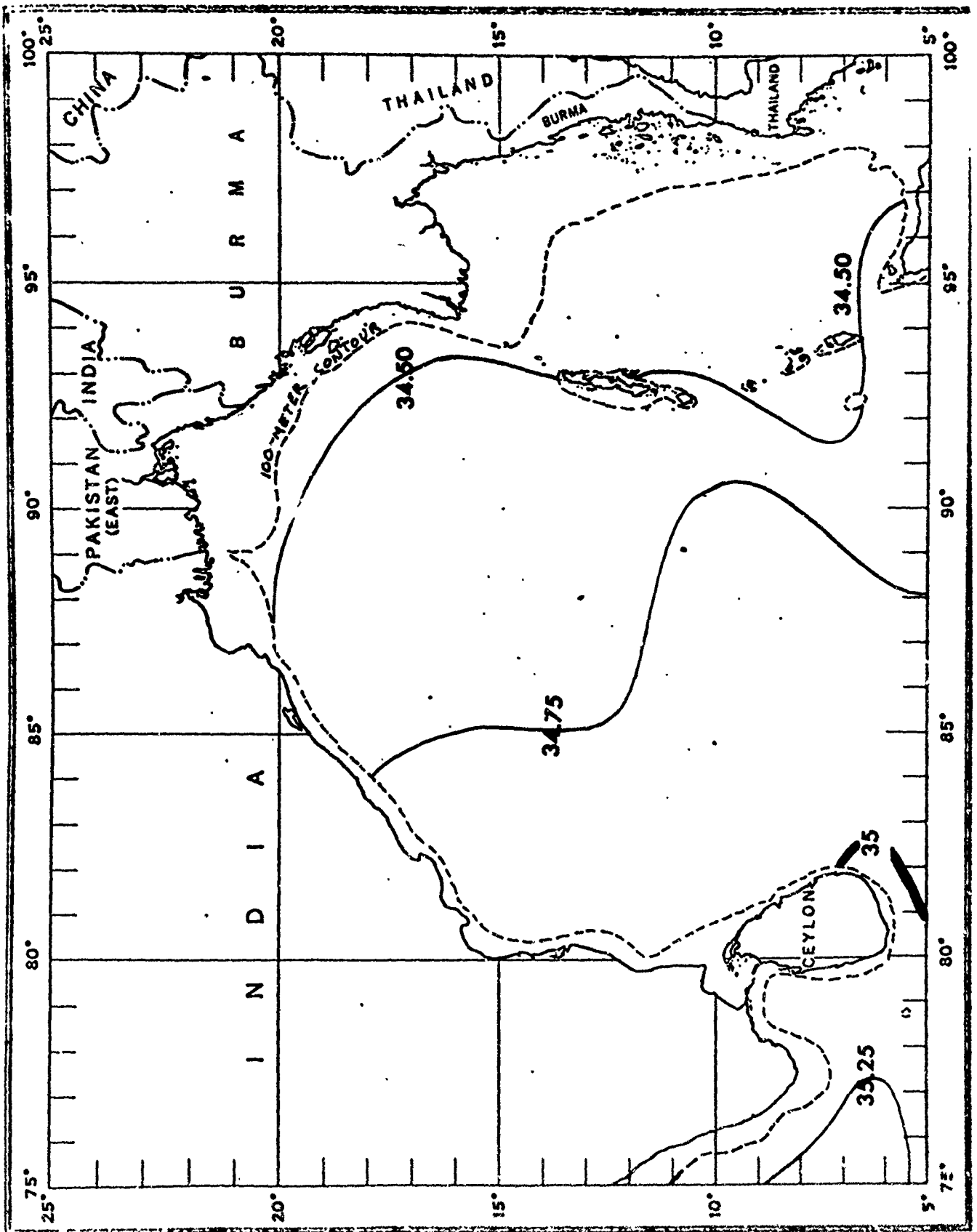


Figure 32 Mean salinity (parts per thousand) at 100 meters (328 feet), July through September

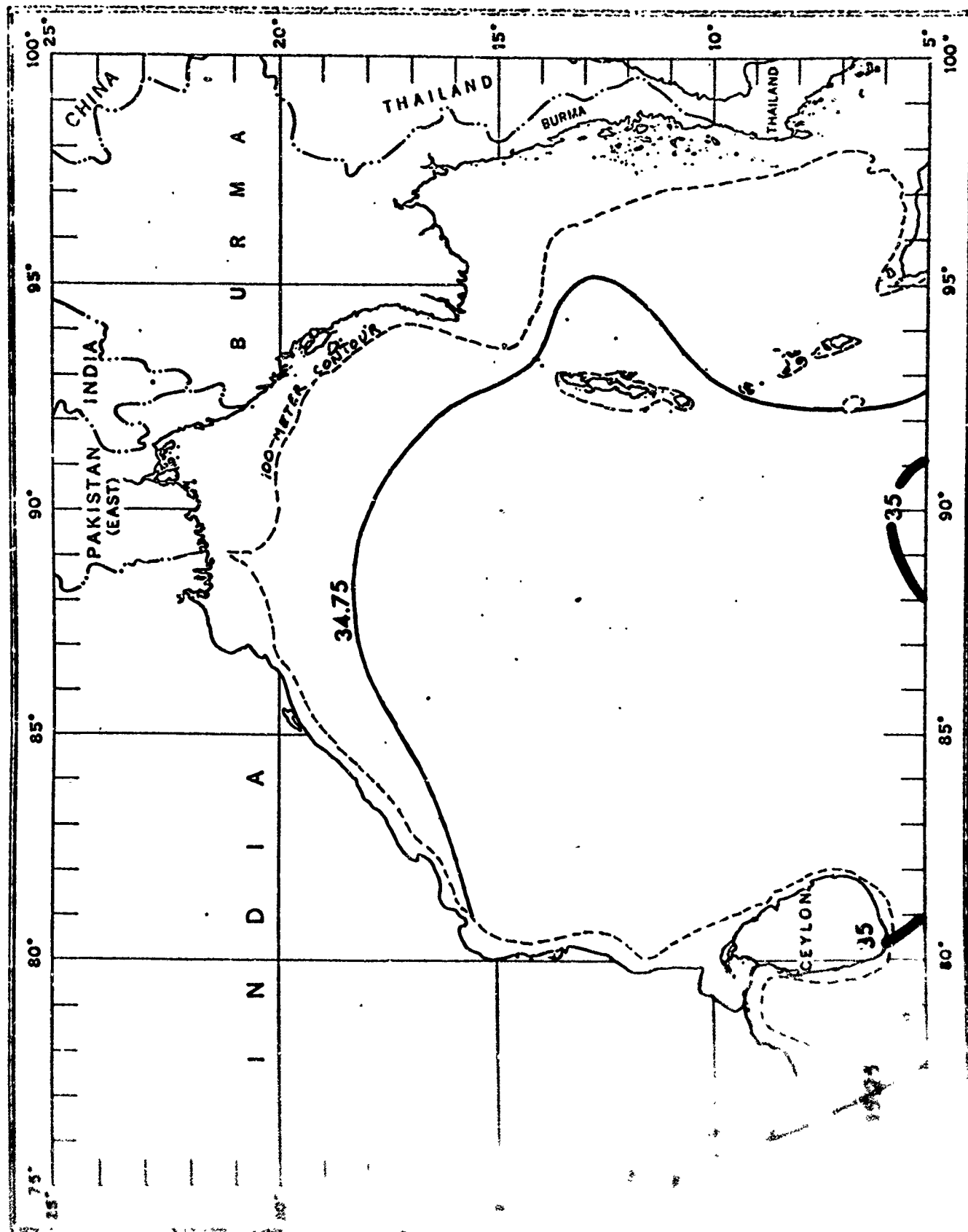


Figure 11
Map of the Indian Ocean showing depth contours and surrounding landmasses.

HORIZONTAL DISTRIBUTION OF DENSITY (σ_t)

Isopycnics are presented in units of σ_t (σ_t). To show greater detail, intermediate values in increments of 0.25 are inserted (thin lines) wherever possible. To improve the analysis, the mean temperature and salinity distributions were combined to derive the mean density distributions.

In the vicinity of large rivers and in coastal regions with heavy rainfall, density is subject to extensive short-term variations and may be much lower than the indicated offshore values.

Because of its dependence on salinity, density varies extensively in this study area. Hence, the mean distribution of sea surface density is presented for the monthly periods shown in Figures 34 through 38. At 100 meters (328 feet), where the variability is smaller and the data are sparse, the density distribution is given by trimonthly periods and is presented in Figures 39 through 42.

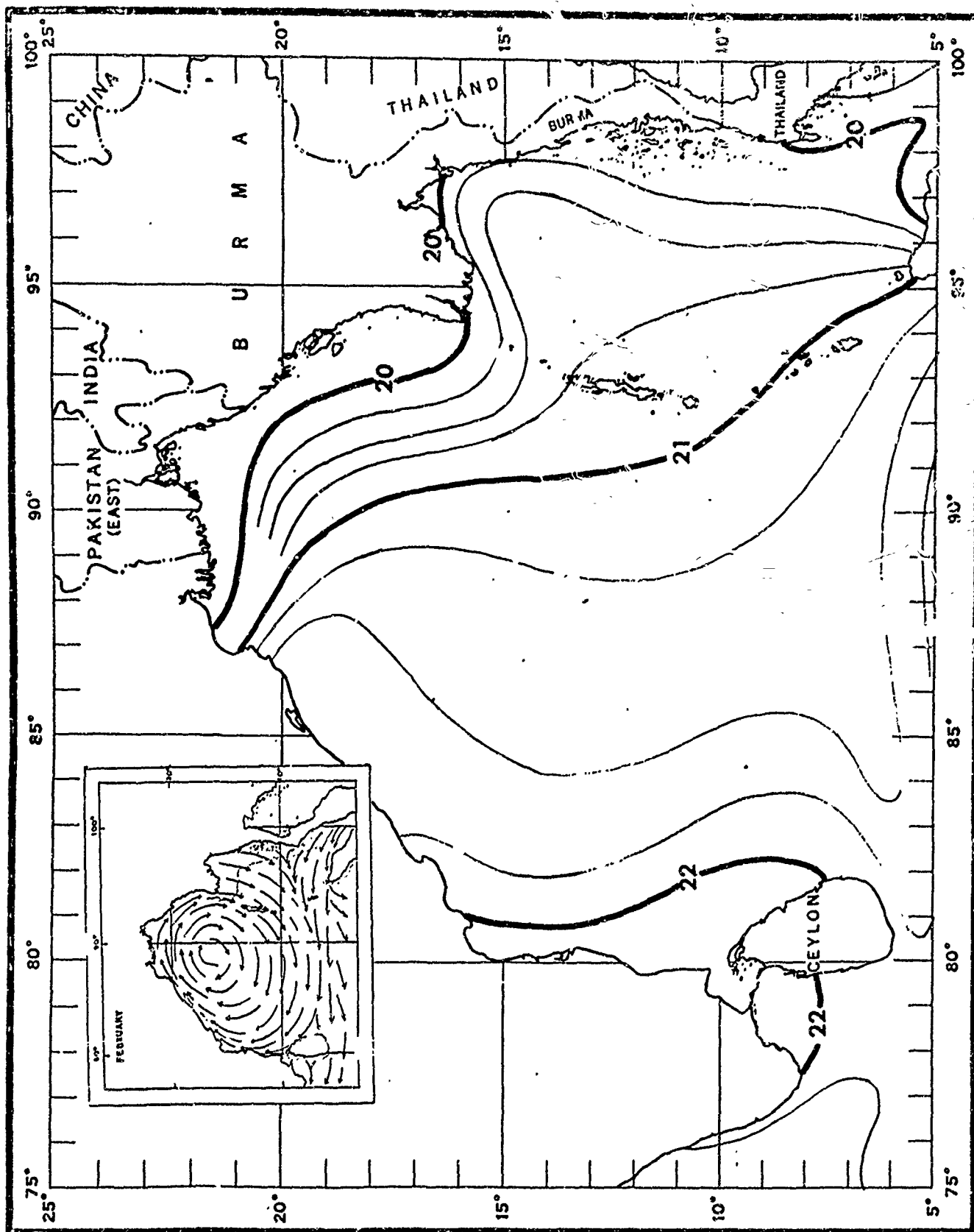


Figure 34 Mean sea surface density (σ_t), February

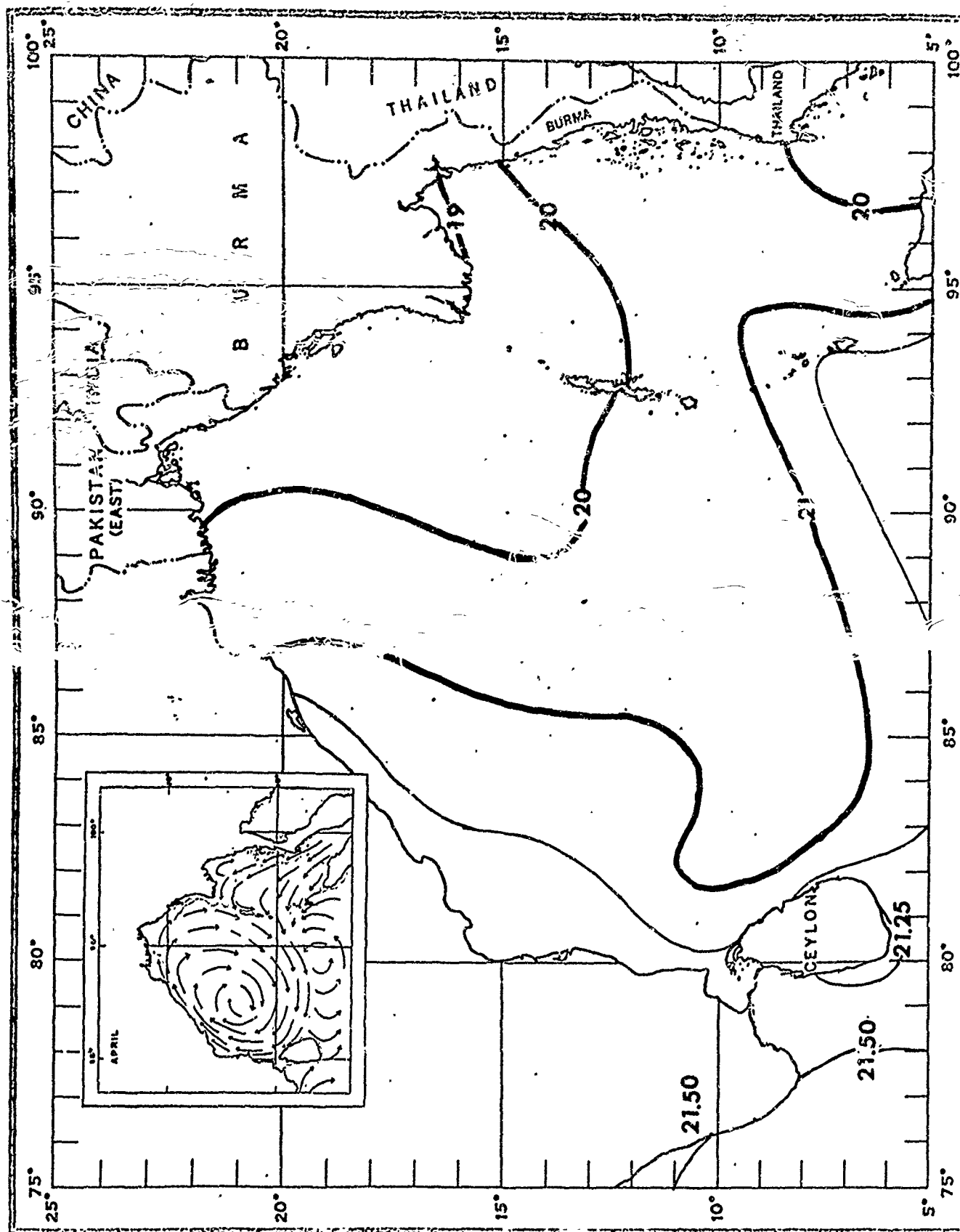


Figure 35 Mean sea surface density (σ_t)

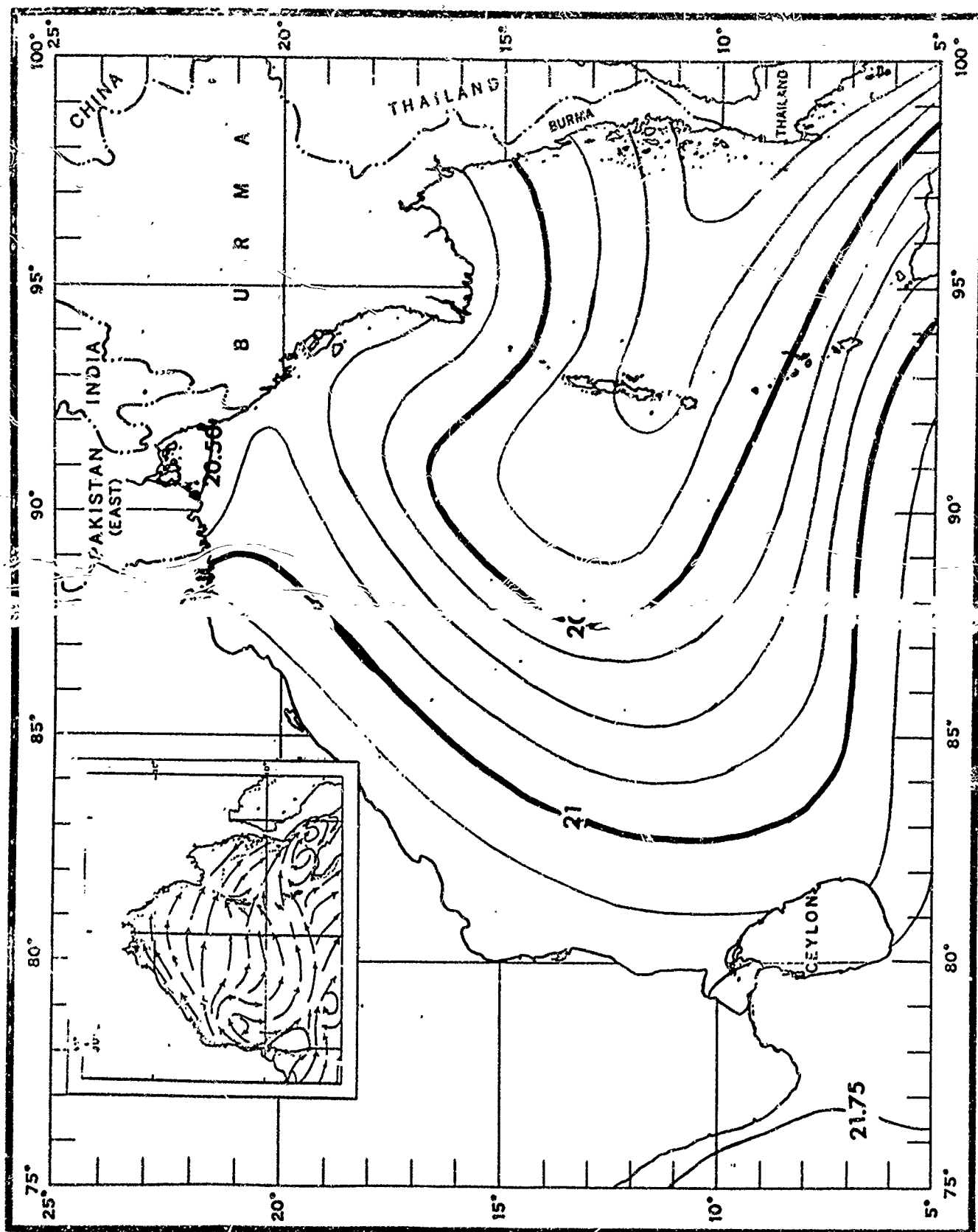


Figure 36 Mean sea surface density (σ_t), June

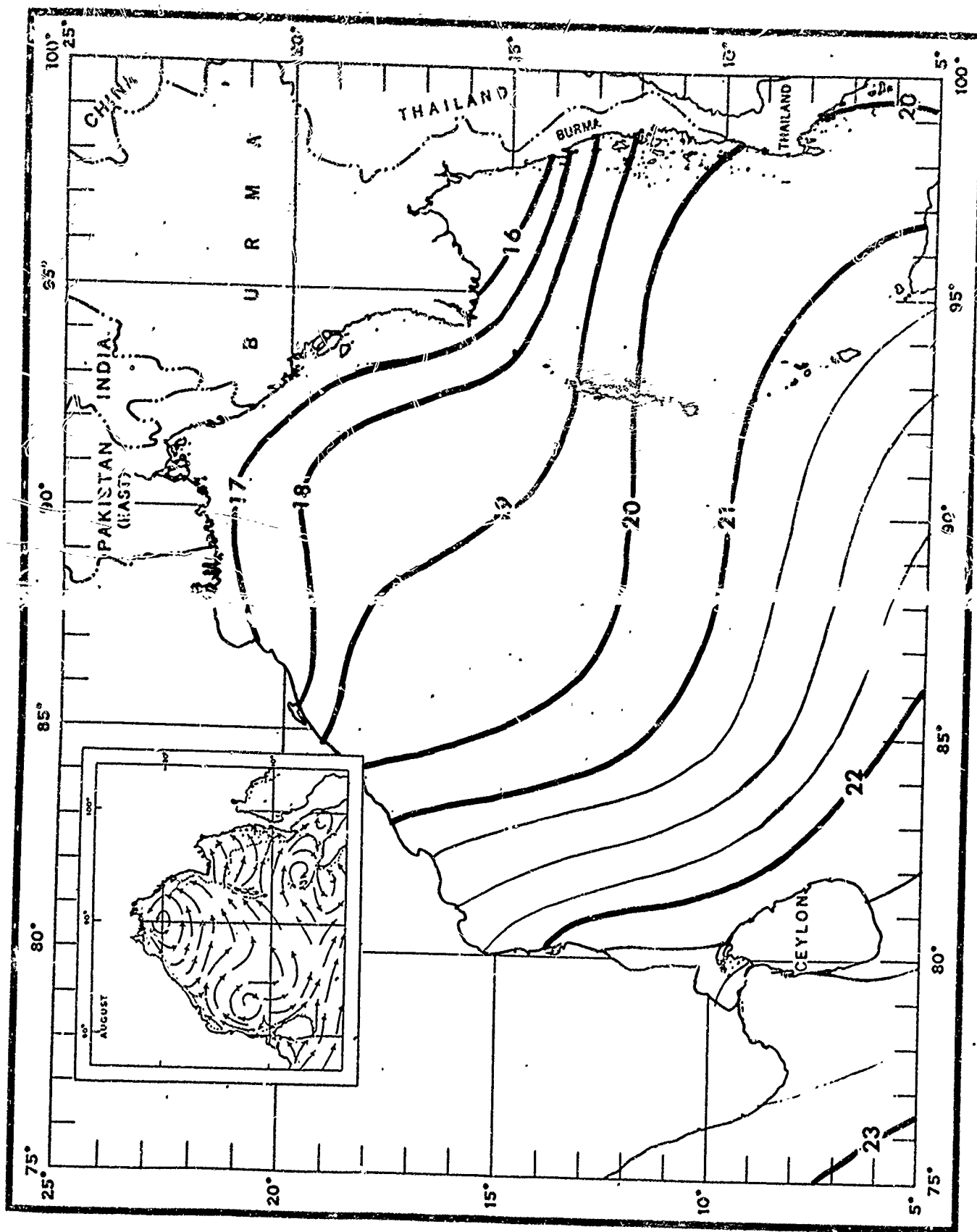


Figure 37 Mean sea surface density (σ_t), August

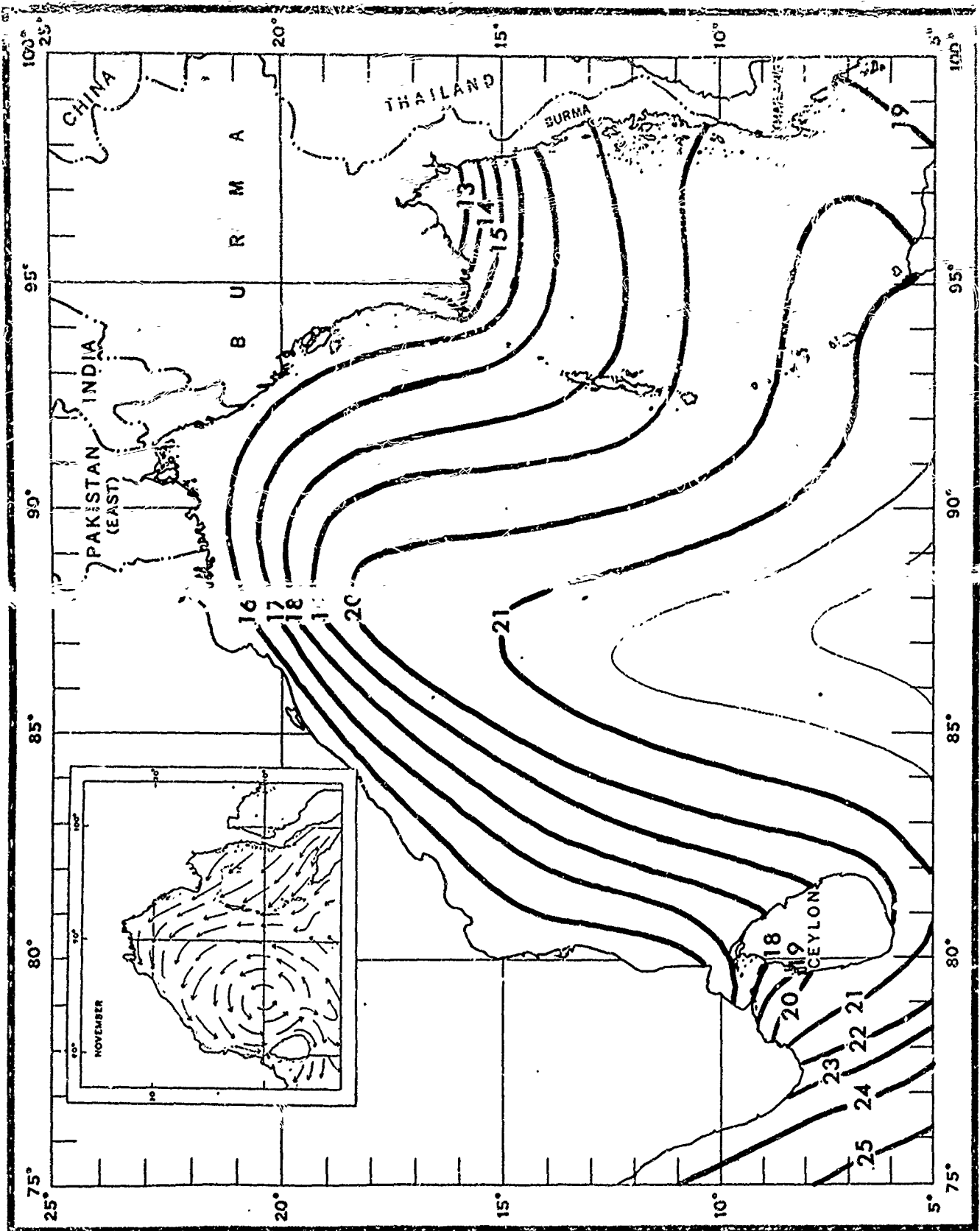


Figure 38 Mean sea surface density (σ_t), November

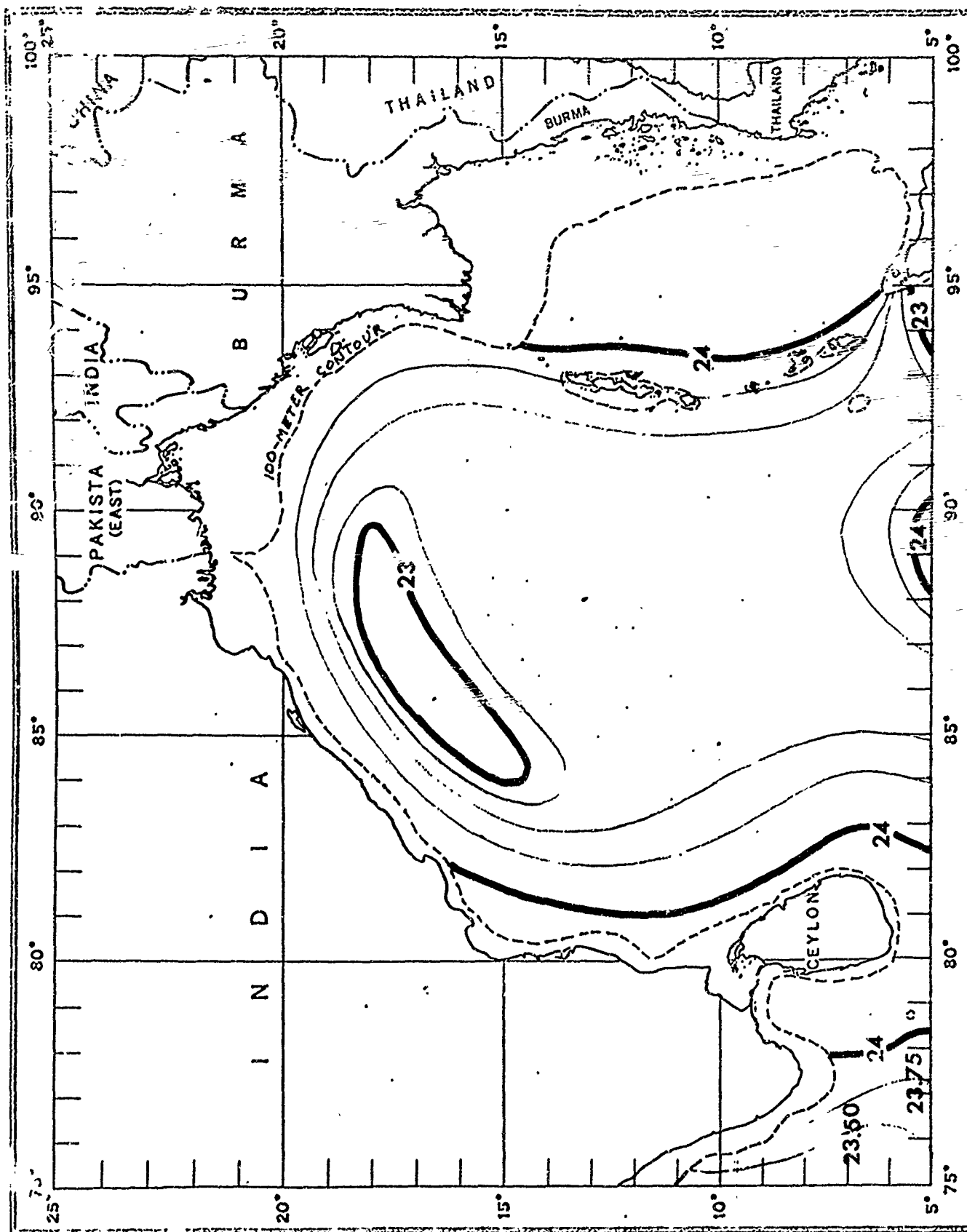


Figure 39 Mean density (σ_t) at 100 meters (328 feet),
January through March

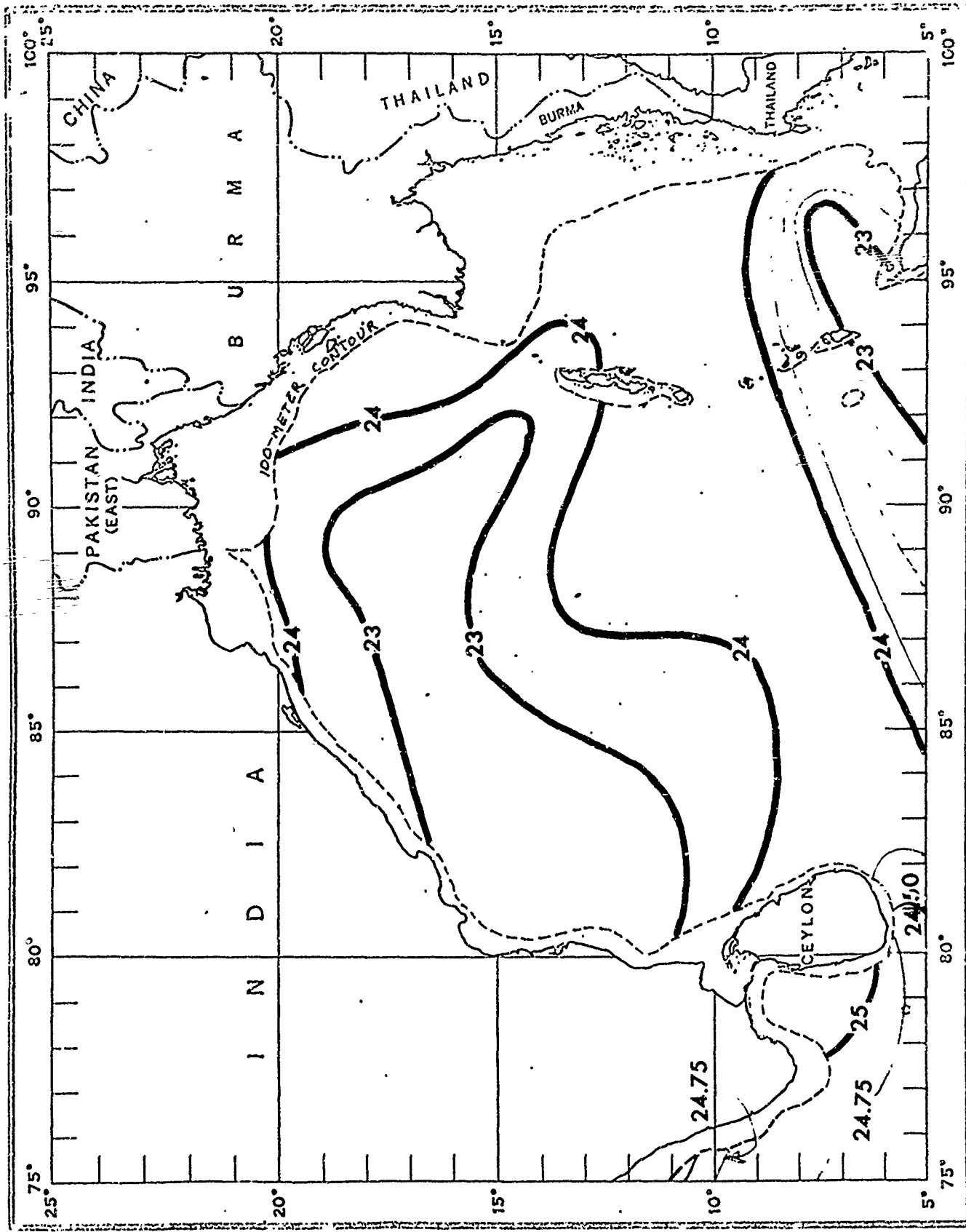


Figure 40 Mean density (σ_t) at 100 meters (328 feet),
April through June

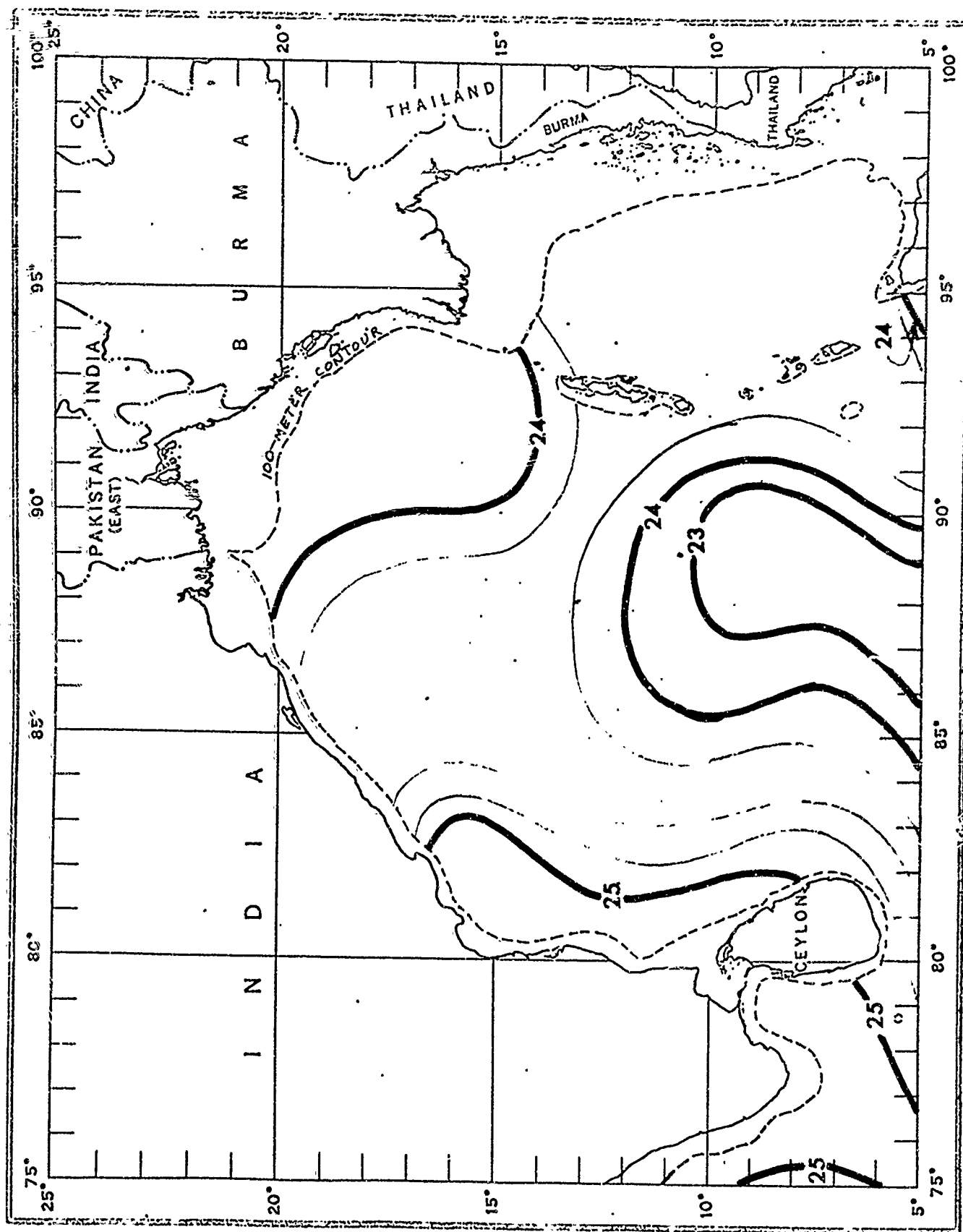


Figure 41 Mean density (σ_t) at 100 meters (328 feet),
July through September

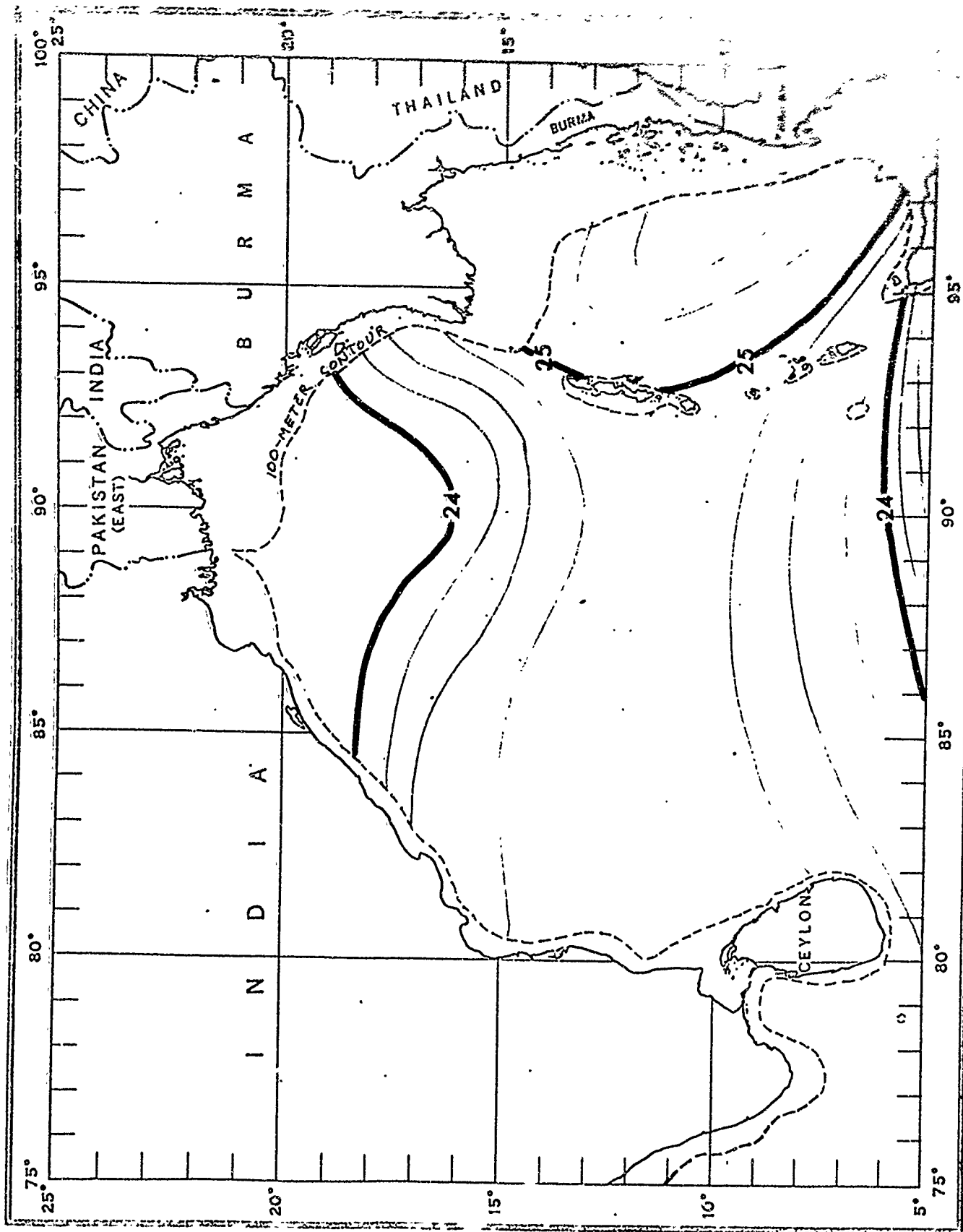


Figure 42 Mean density (σ_t) at 100 meters (328 feet),
October through December

VERTICAL DISTRIBUTION OF TEMPERATURE, SALINITY, AND DENSITY

Typical traces of temperature, salinity, and density in the upper 610 meters (2,000 feet) are displayed in Figures 43 through 62 for trimonthly periods and selected regions. These modal traces represent the most common vertical trace found in each region and are enclosed in an envelope containing 100% of the data.

In addition, the strength of the vertical temperature gradient is shown for the same periods and regions with the exception that some of the southernmost regions are omitted. These graphs show a line representative of the medial gradient within two envelopes representing the distribution of gradients for 50% and 100% of the data.

Deep traces of temperature, salinity, and density based on selected oceanographic stations that extend deeper than 610 meters (2,000 feet) are given in Figures 63 through 65 for one month of each trimonthly period.

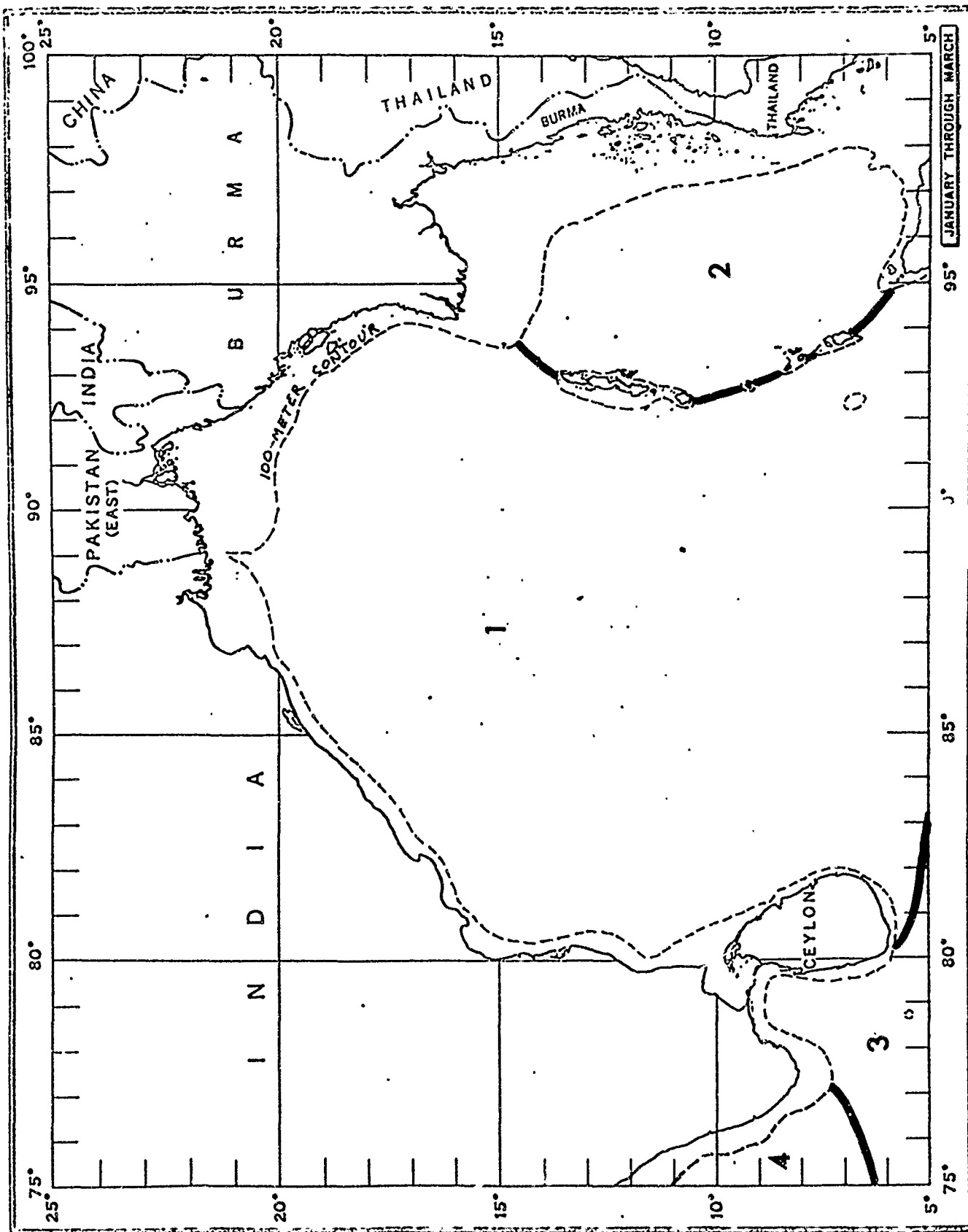


Figure 43 Locator chart for typical traces, January through March

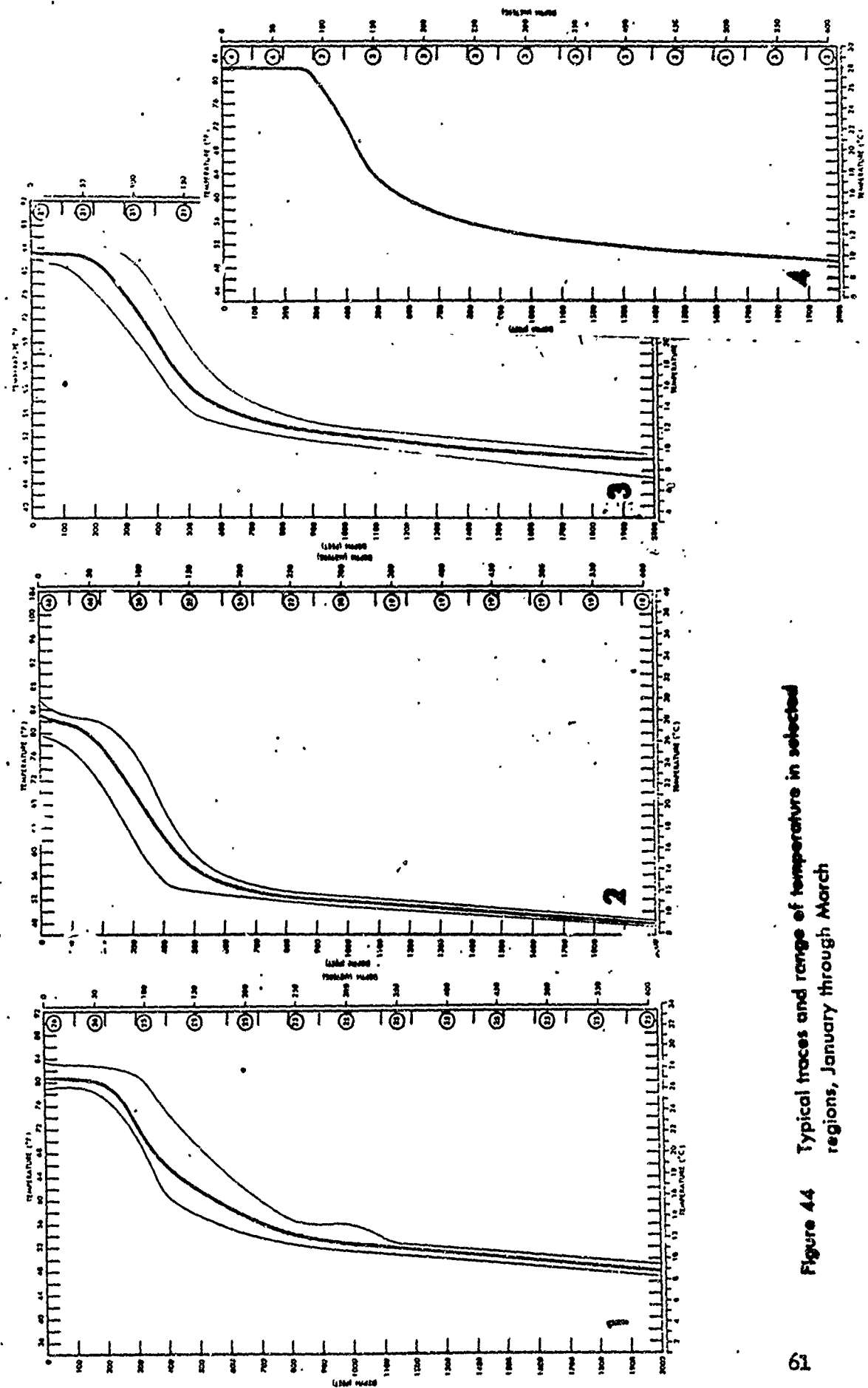


Figure 44 Typical traces and range of temperature in selected regions, January through March

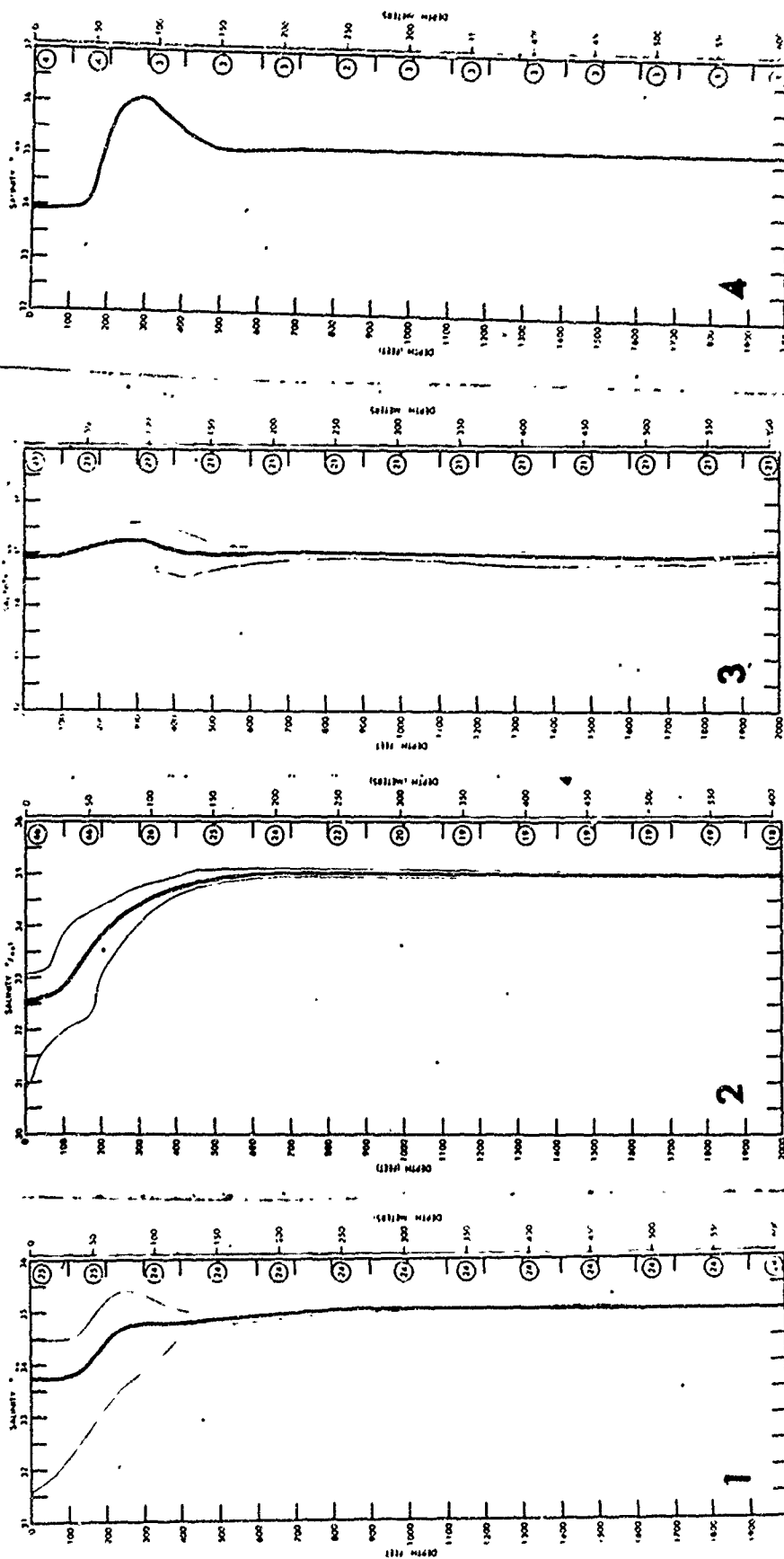


Figure 45 Typical traces and range of salinity in selected regions, January through March

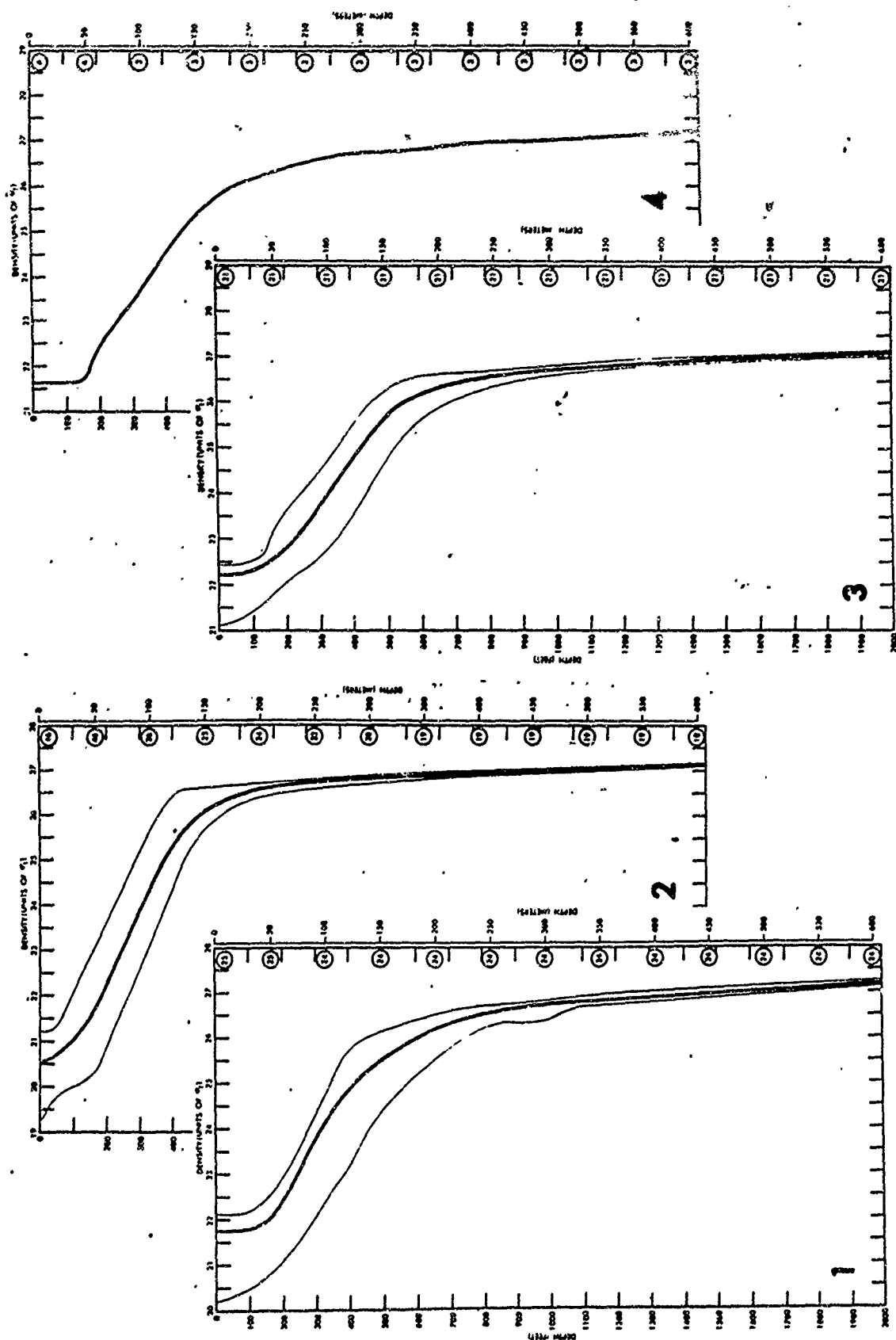


Figure 46 Typical traces and range of density in selected regions, January through March

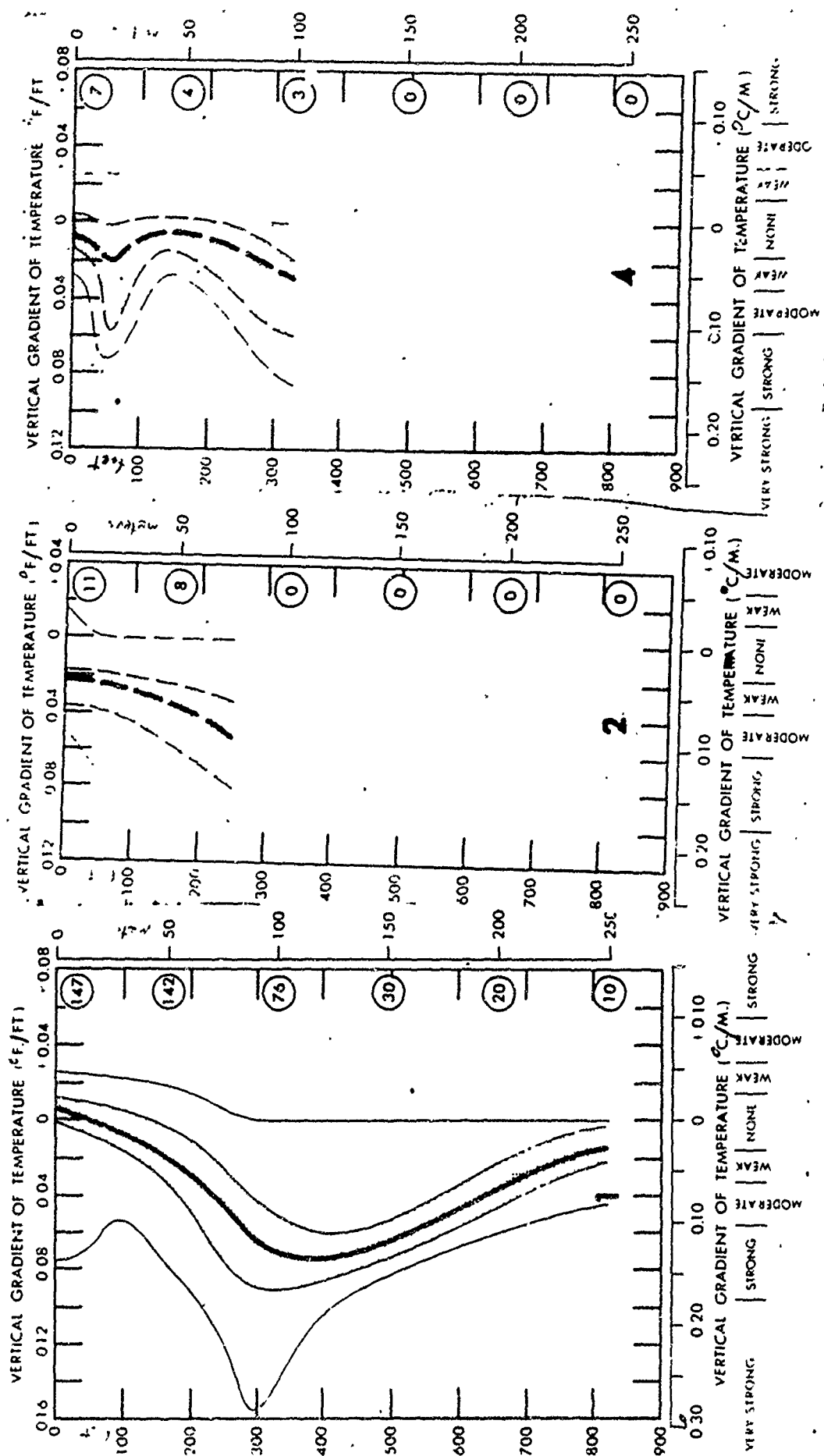


Figure 4. Vertical gradients of temperature in selected regions, January through March

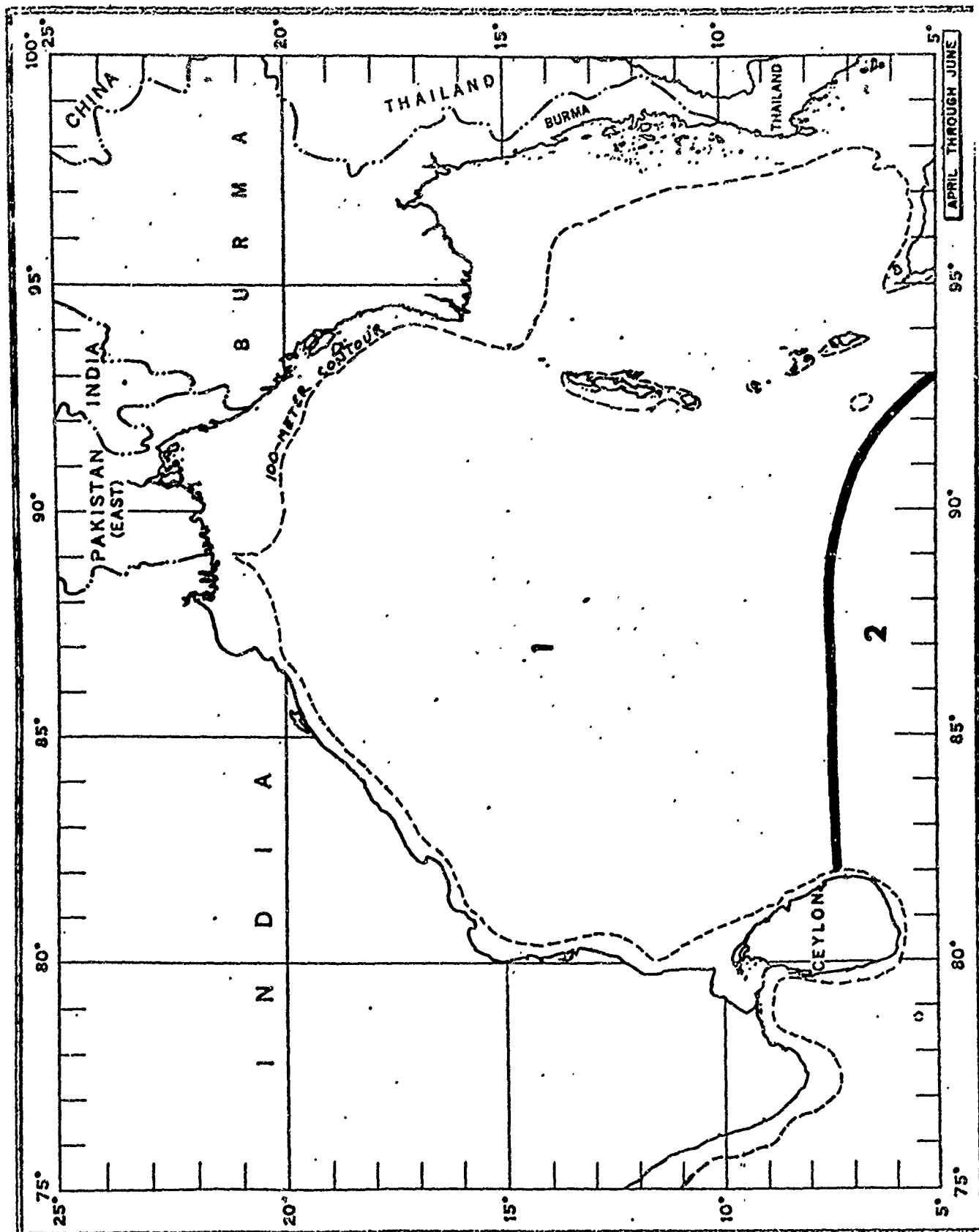


Figure 48 Locator chart for typical traces, April through June

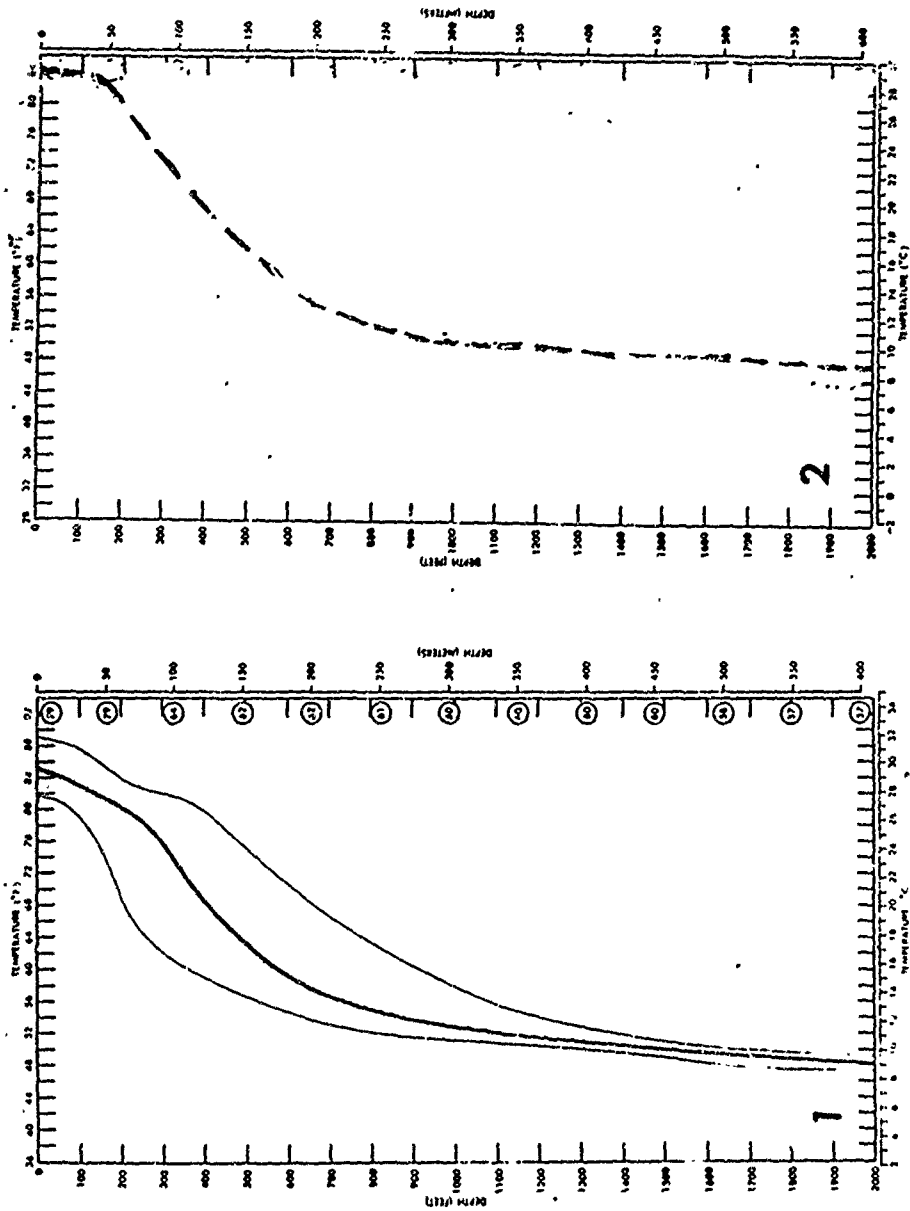


Figure 49 Typical traces and range of temperature in selected regions, April through June

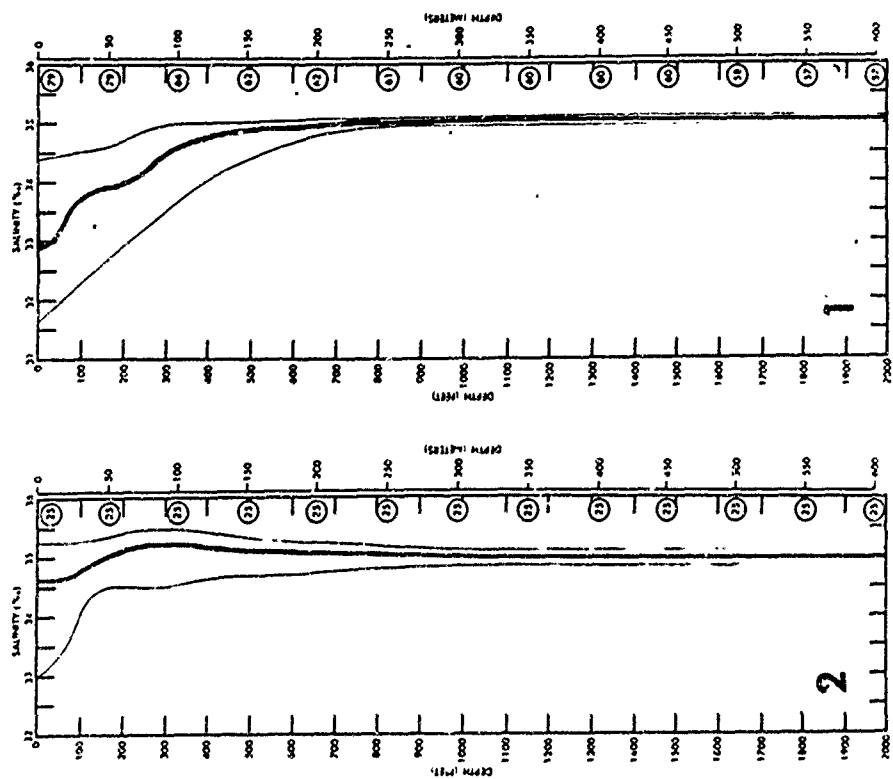


Figure 50 Typical traces and range of salinity in selected regions, April through June

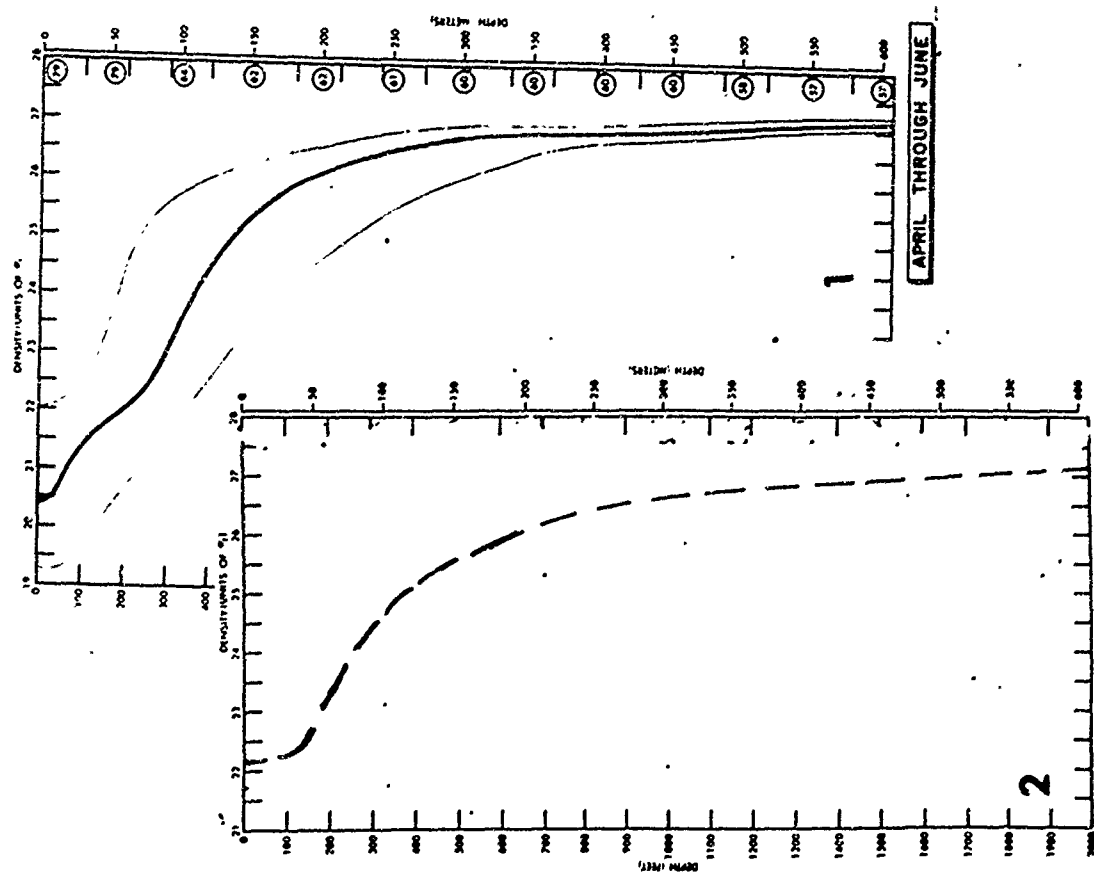


Figure 51 Typical traces and range of density in selected regions, April through June

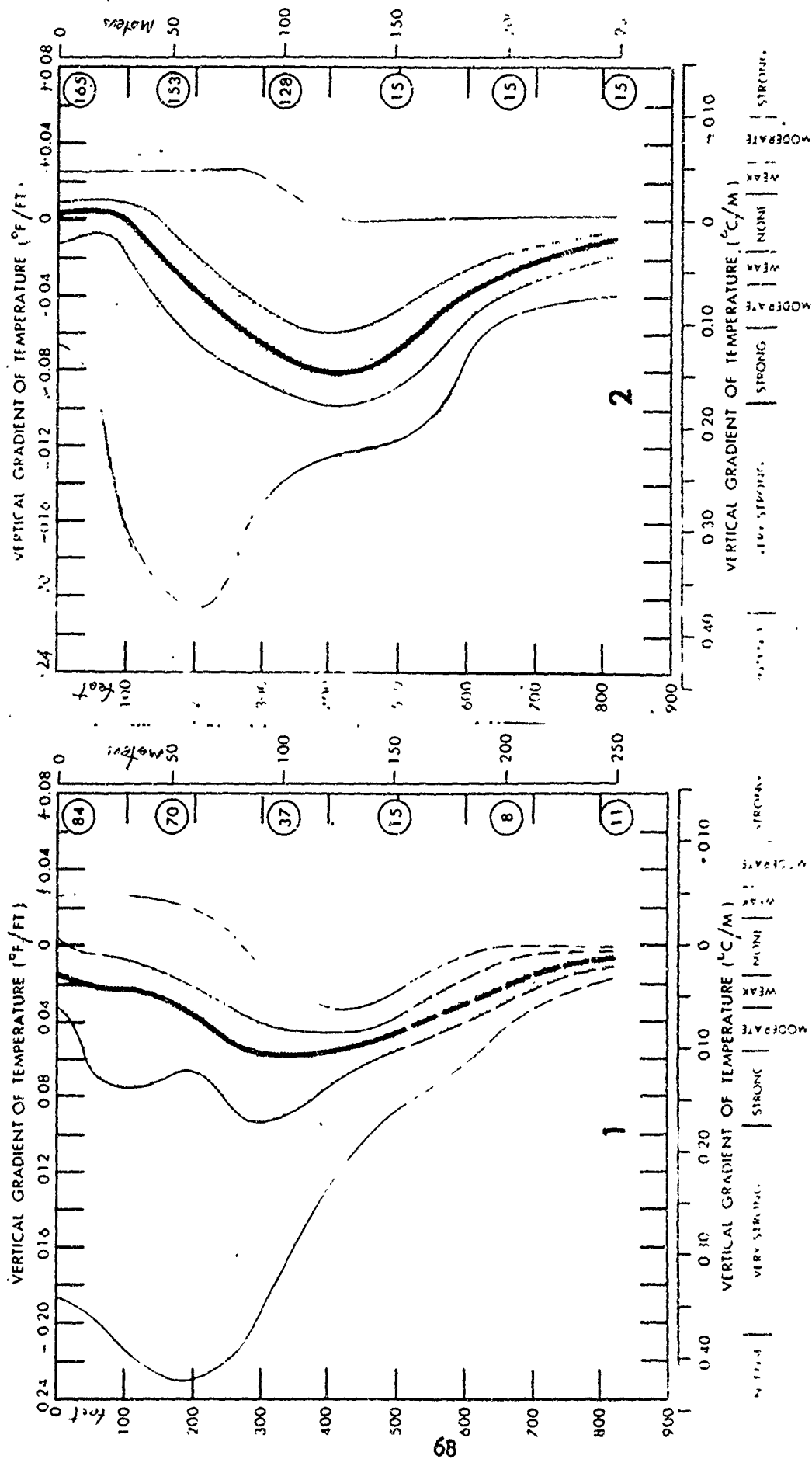


Figure 52 Vertical gradients of temperature in selected regions, April through June

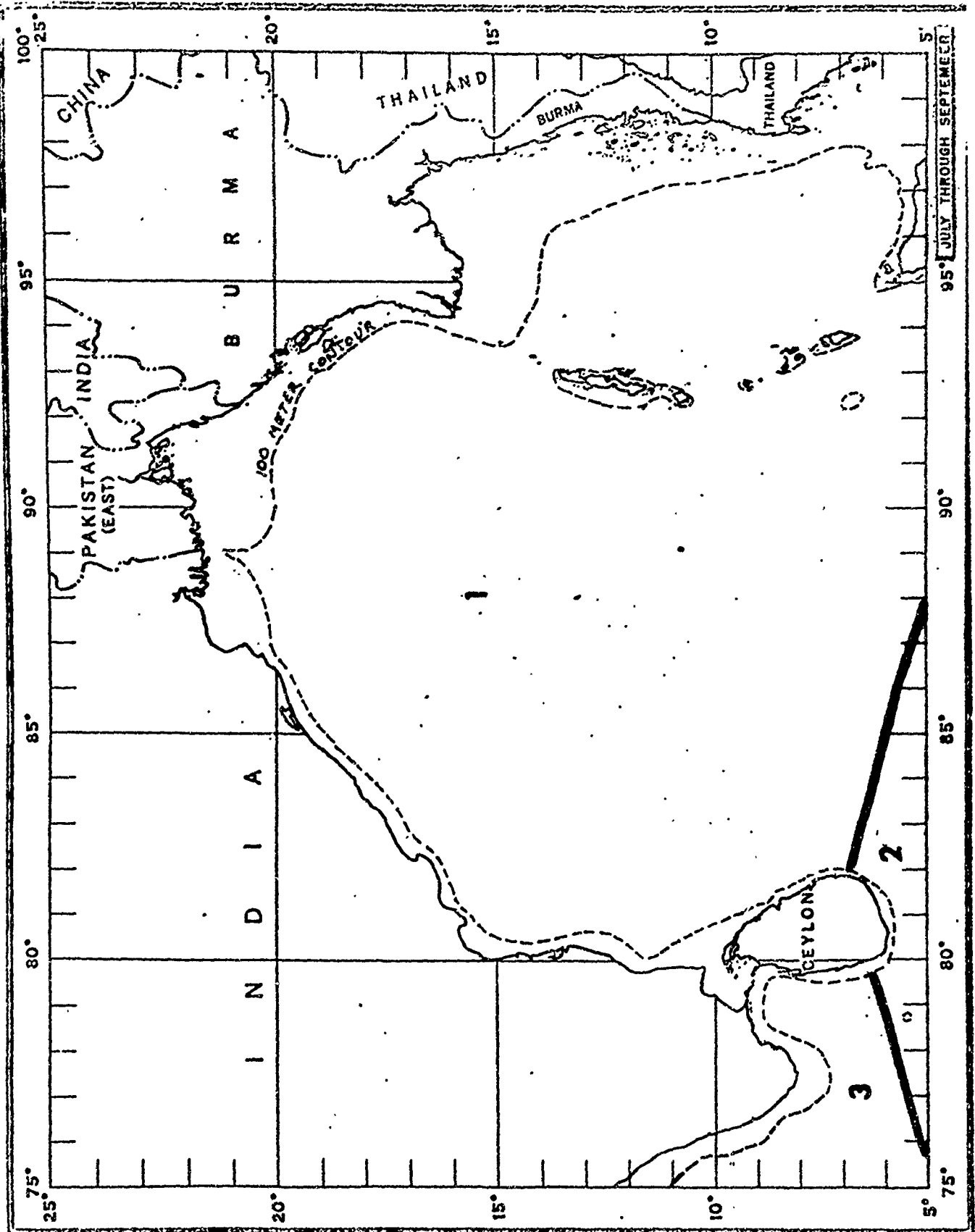


Figure 53 Locator chart for typical traces, July through September

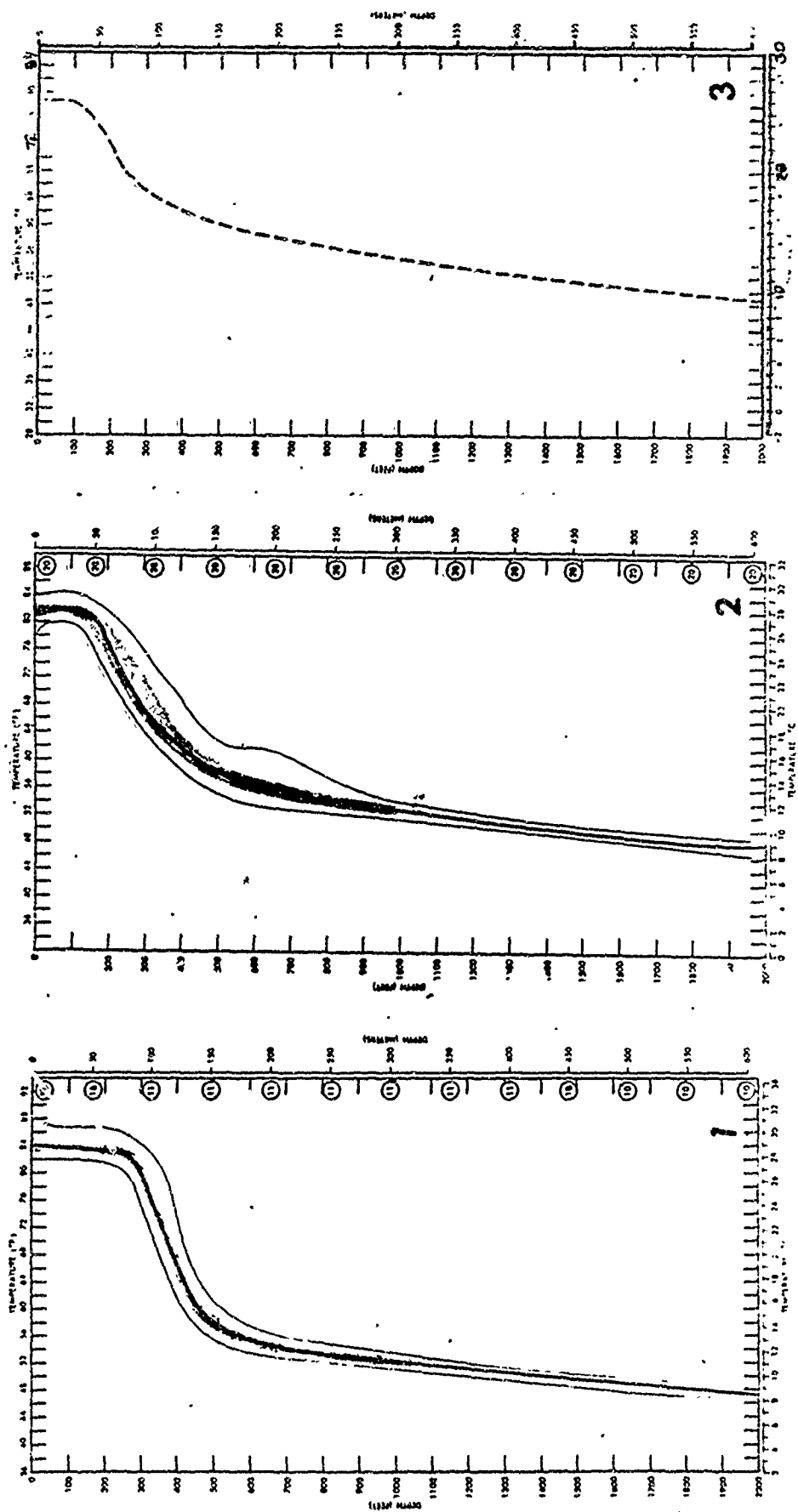


Figure 54 Typical traces and range of temperature in selected regions, July through September

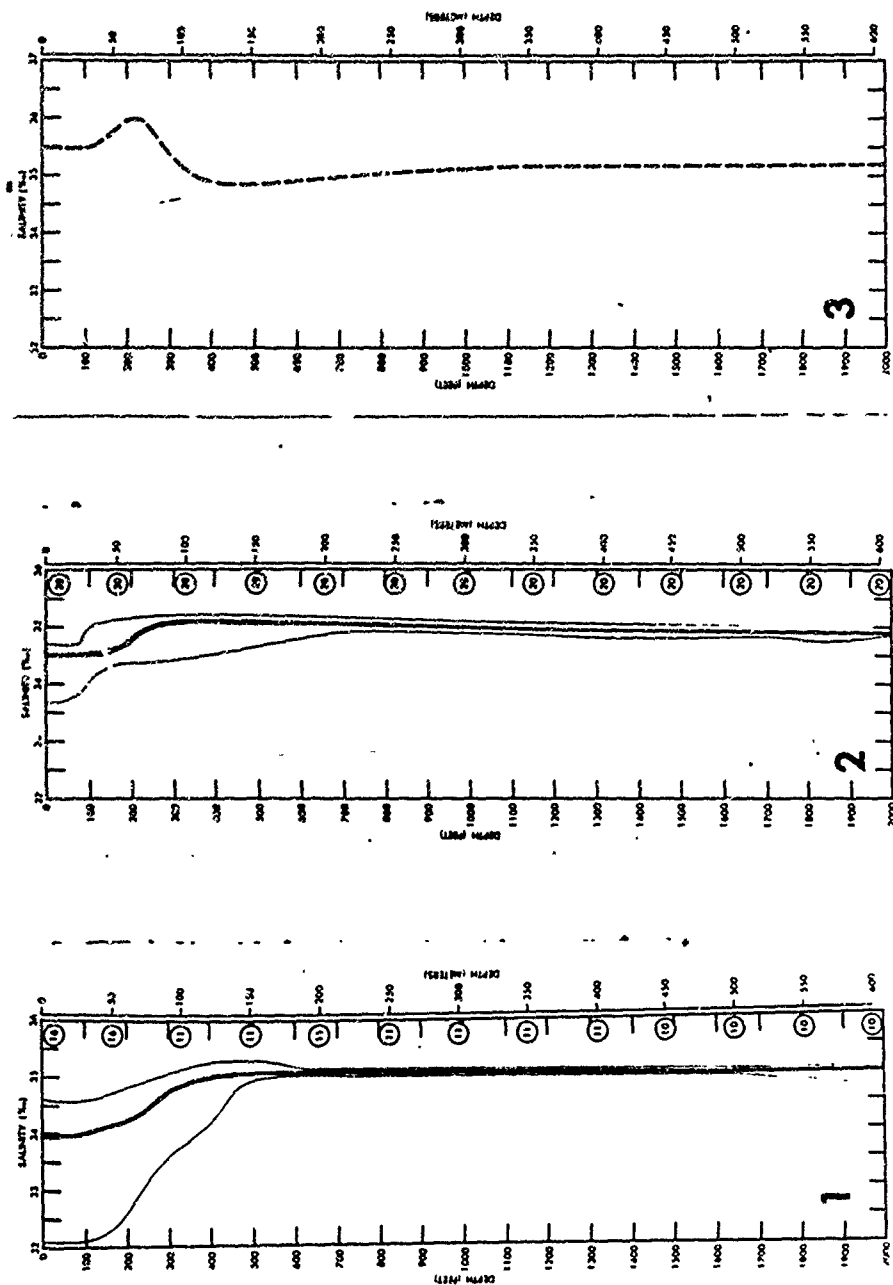


Figure 55 Typical traces and range of salinity in selected regions, July through September

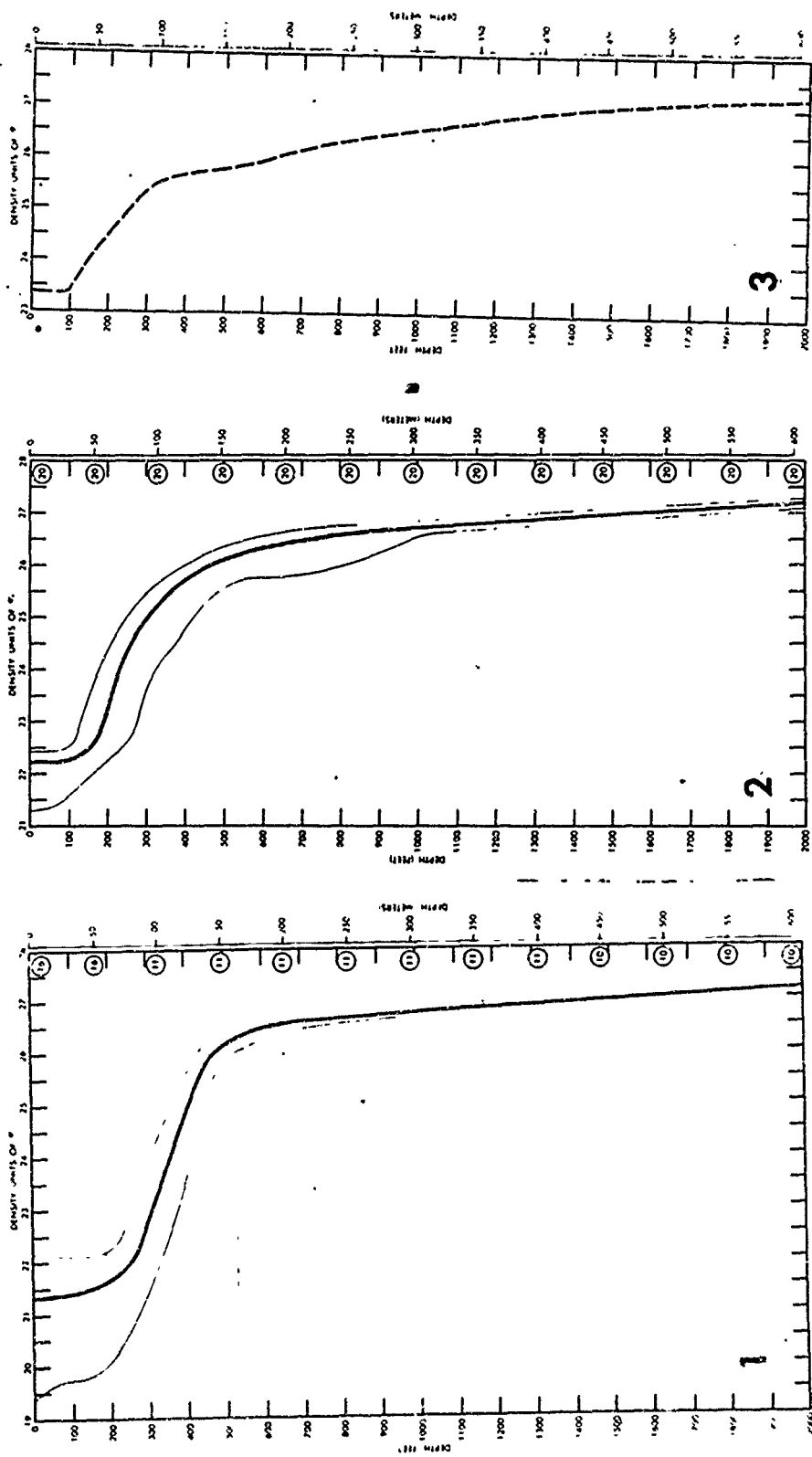


Figure 56 Typical traces and range of density in selected regions, July through September

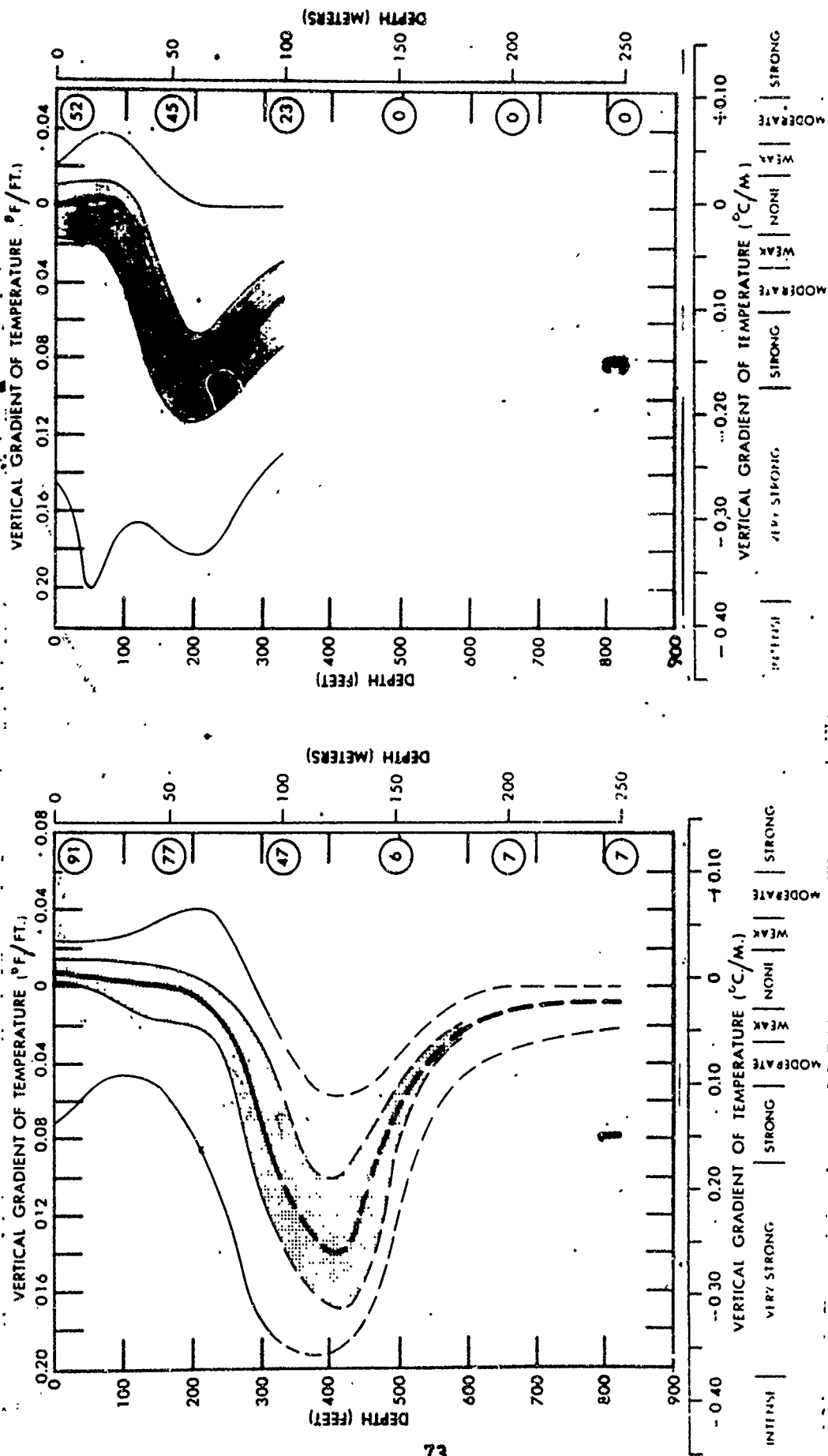


Figure 37: Vertical gradients of temperature in selected regions, July through September

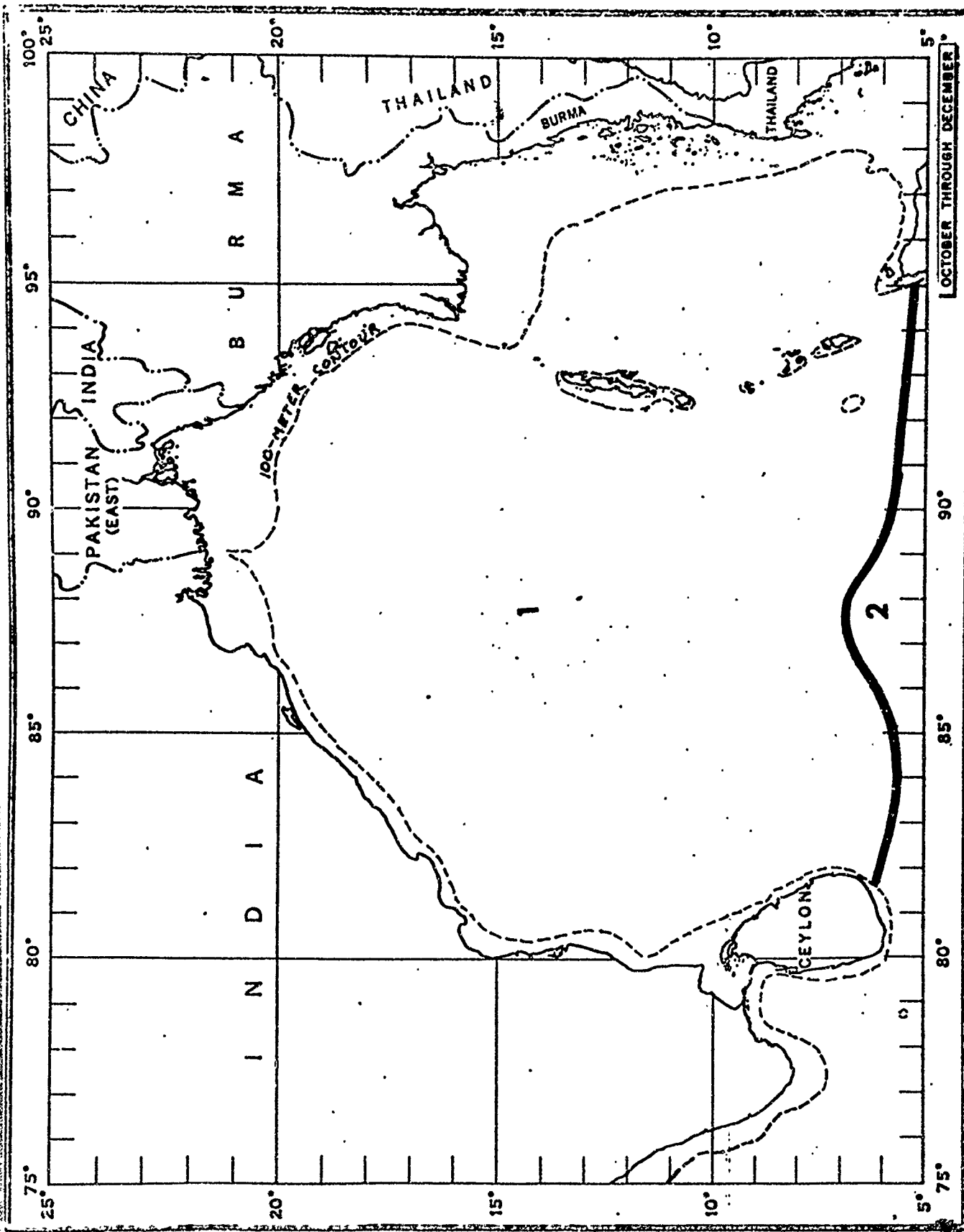


Figure 58 . Locator chart for typical traces, October through December

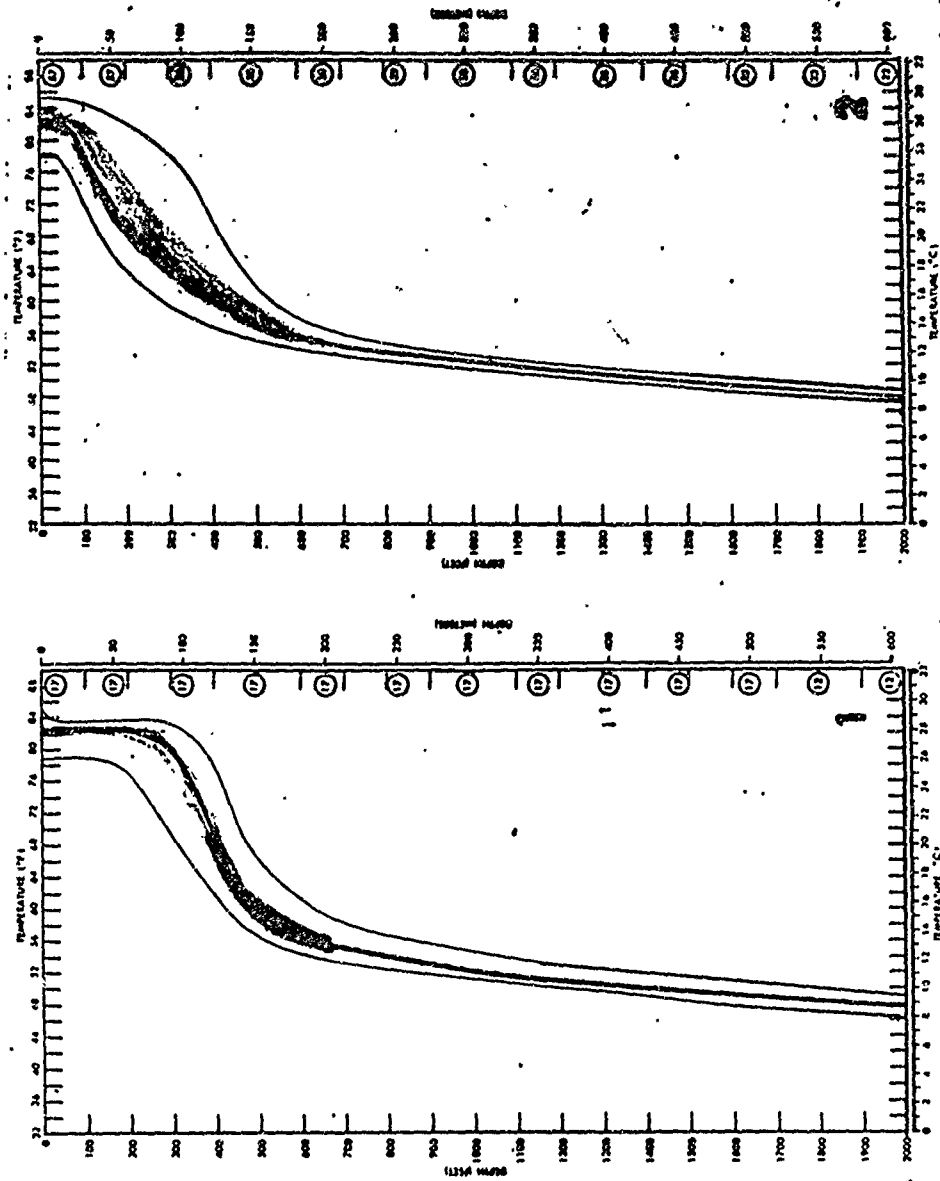


Figure 59 Typical traces and range of temperature in selected regions, October through December

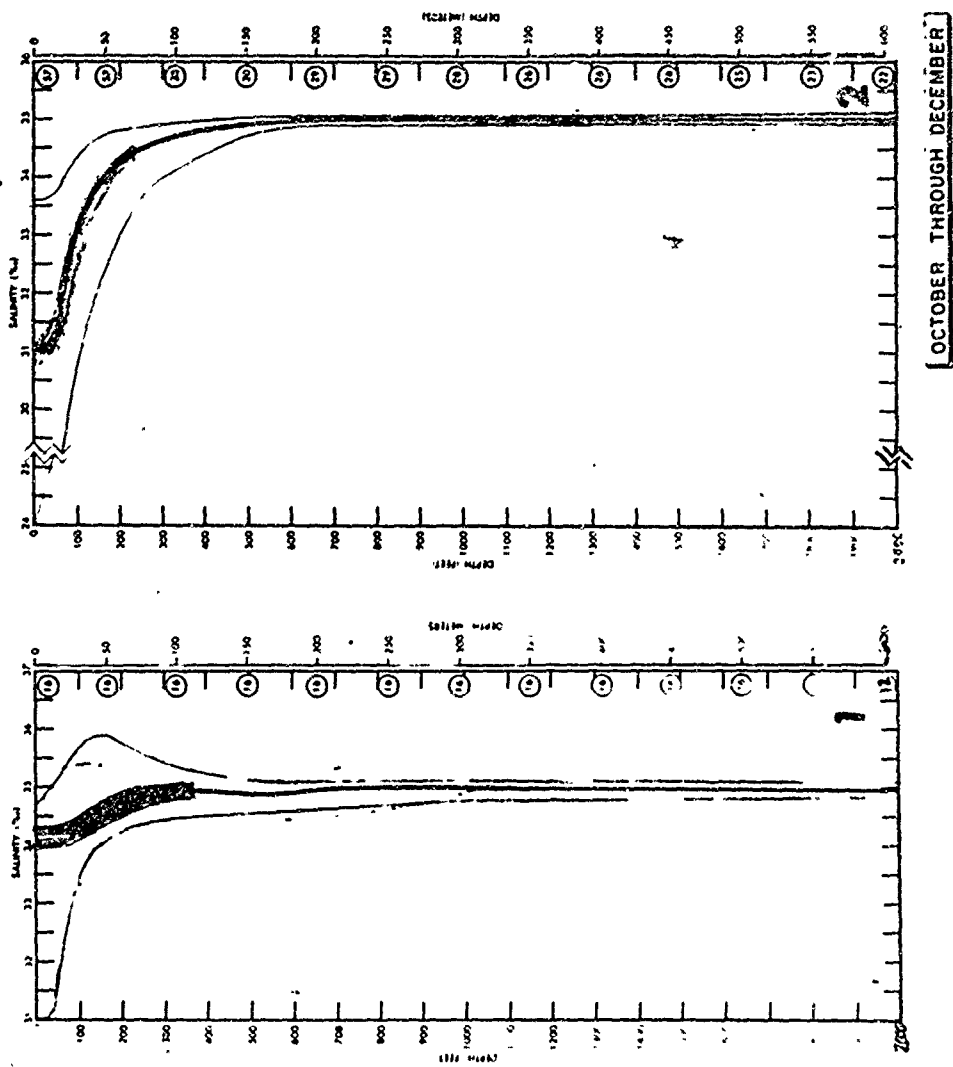


Figure 60 Typical traces and range of salinity in selected regions, October through December

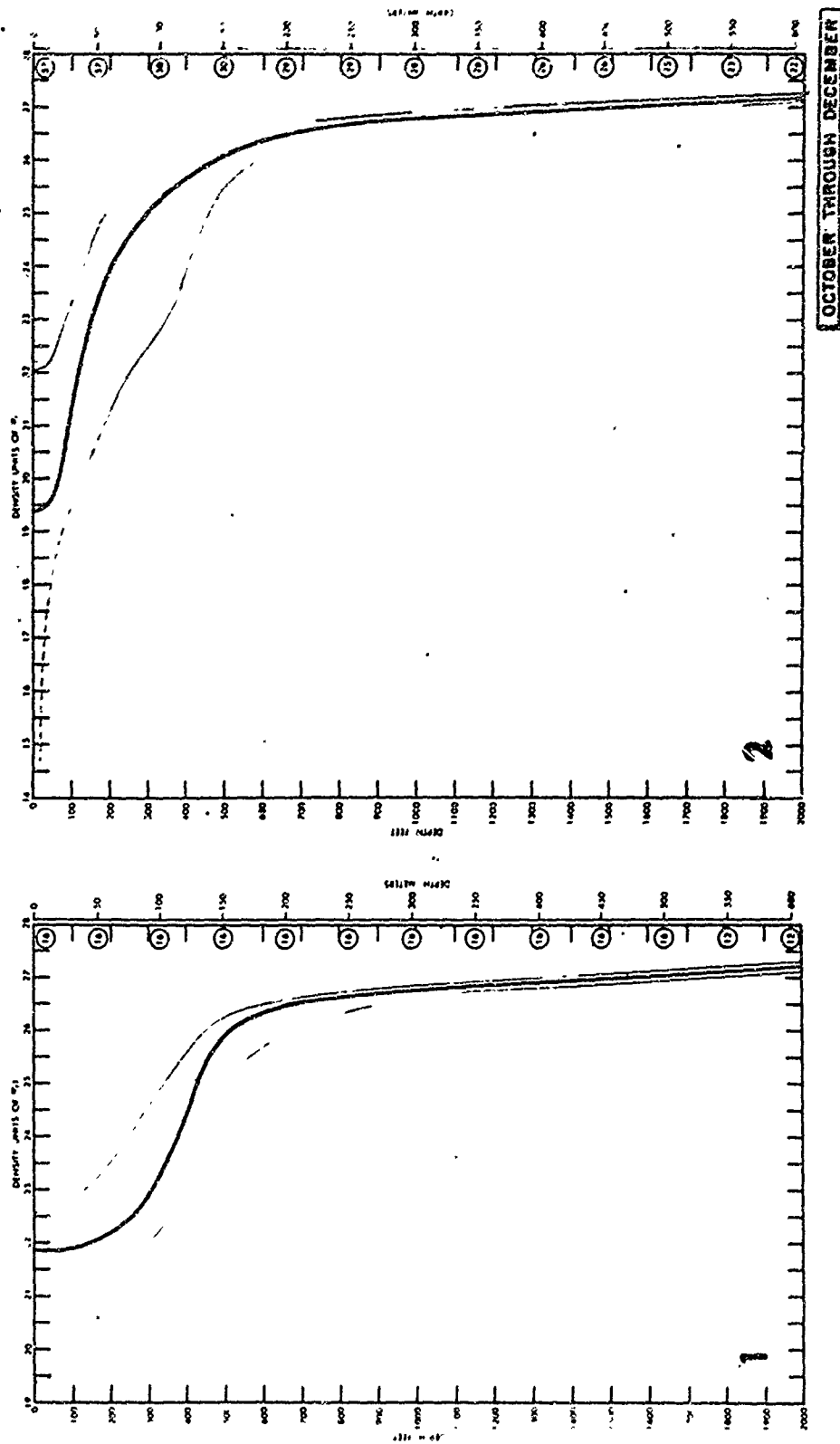


Figure 61 Typical tracks and range of density in selected regions, October through December

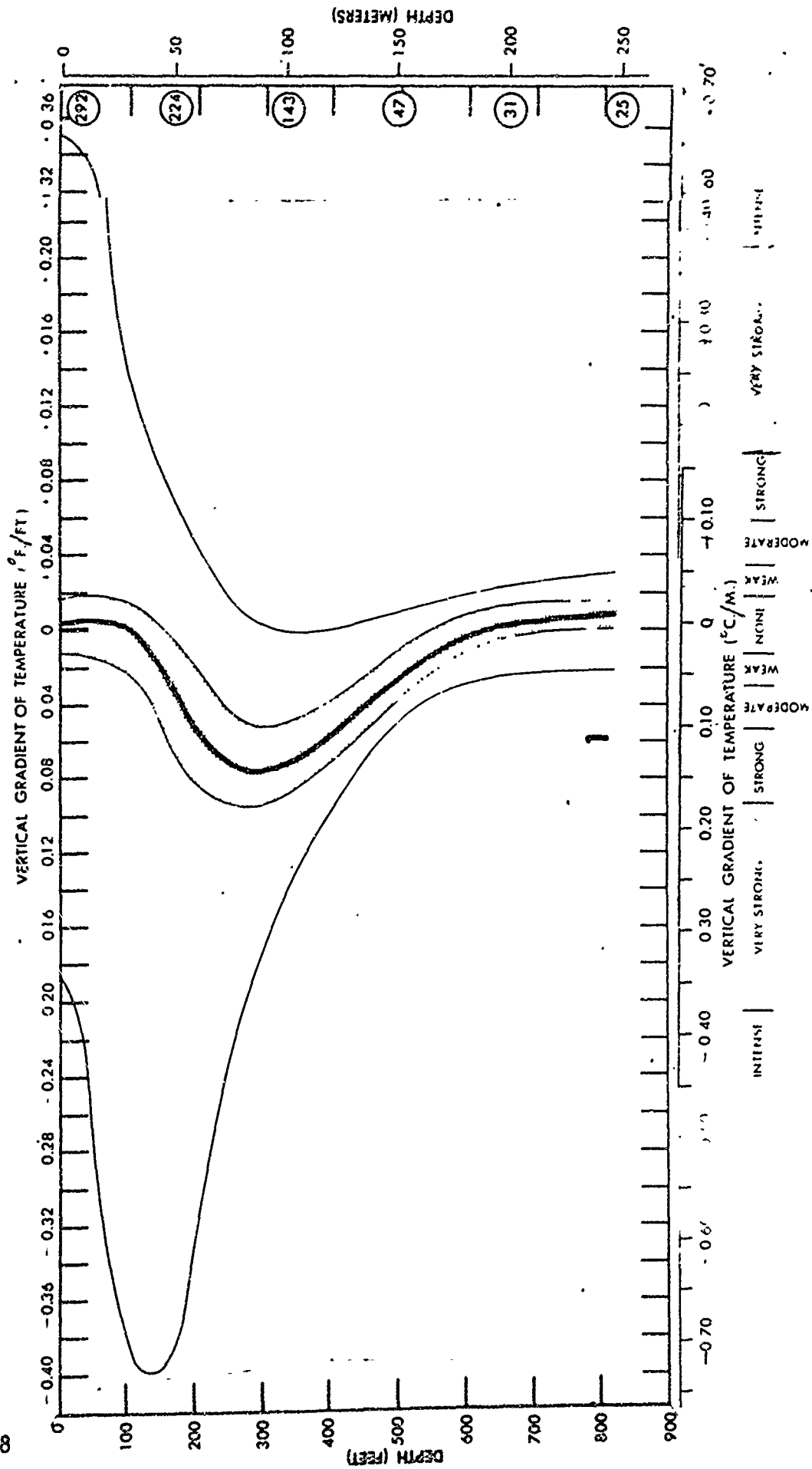


Figure 62 Vertical gradients of temperature in selected regions, October through December

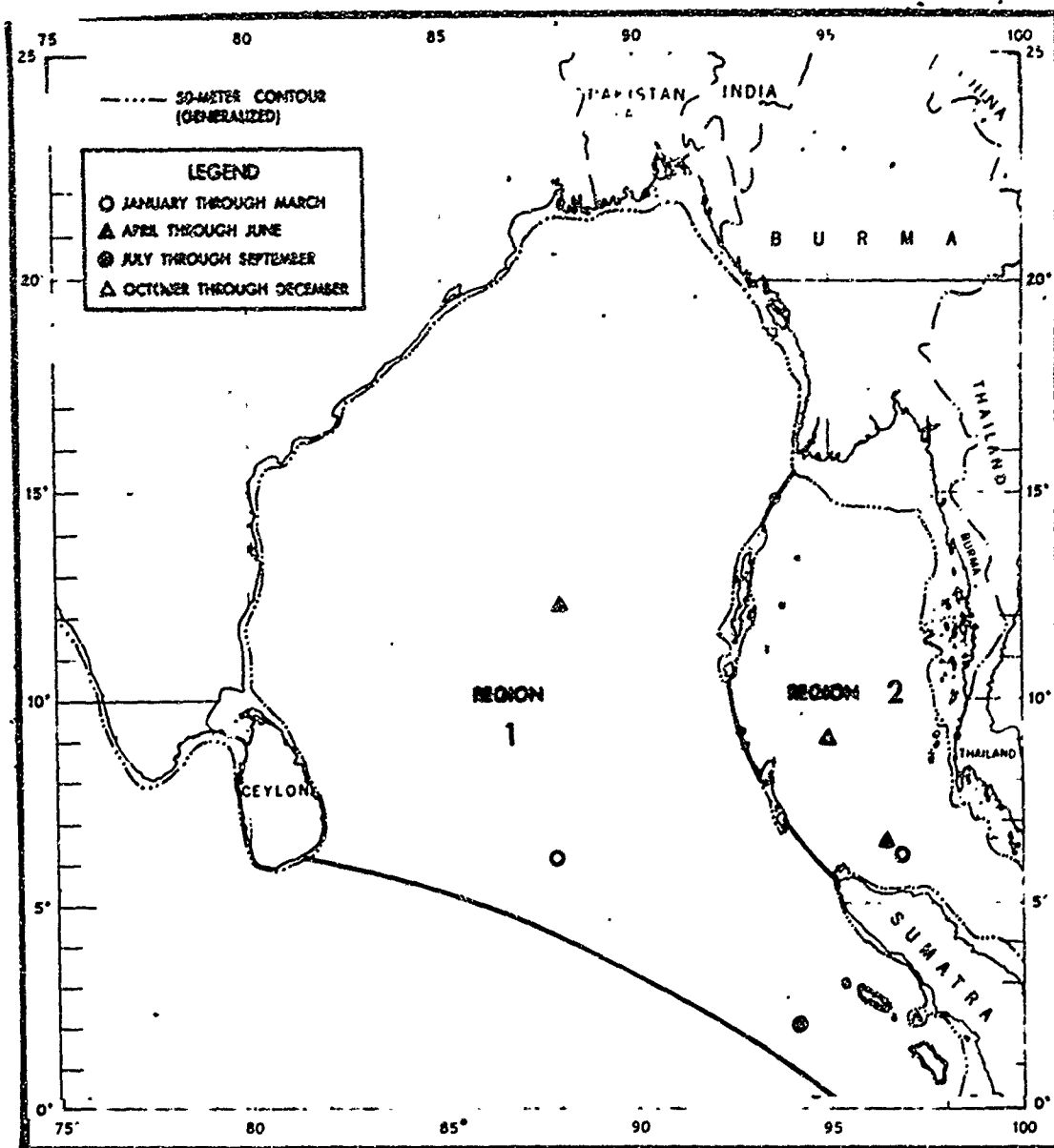


Figure 63 Locator chart for deep traces of temperature, salinity, and density at selected locations

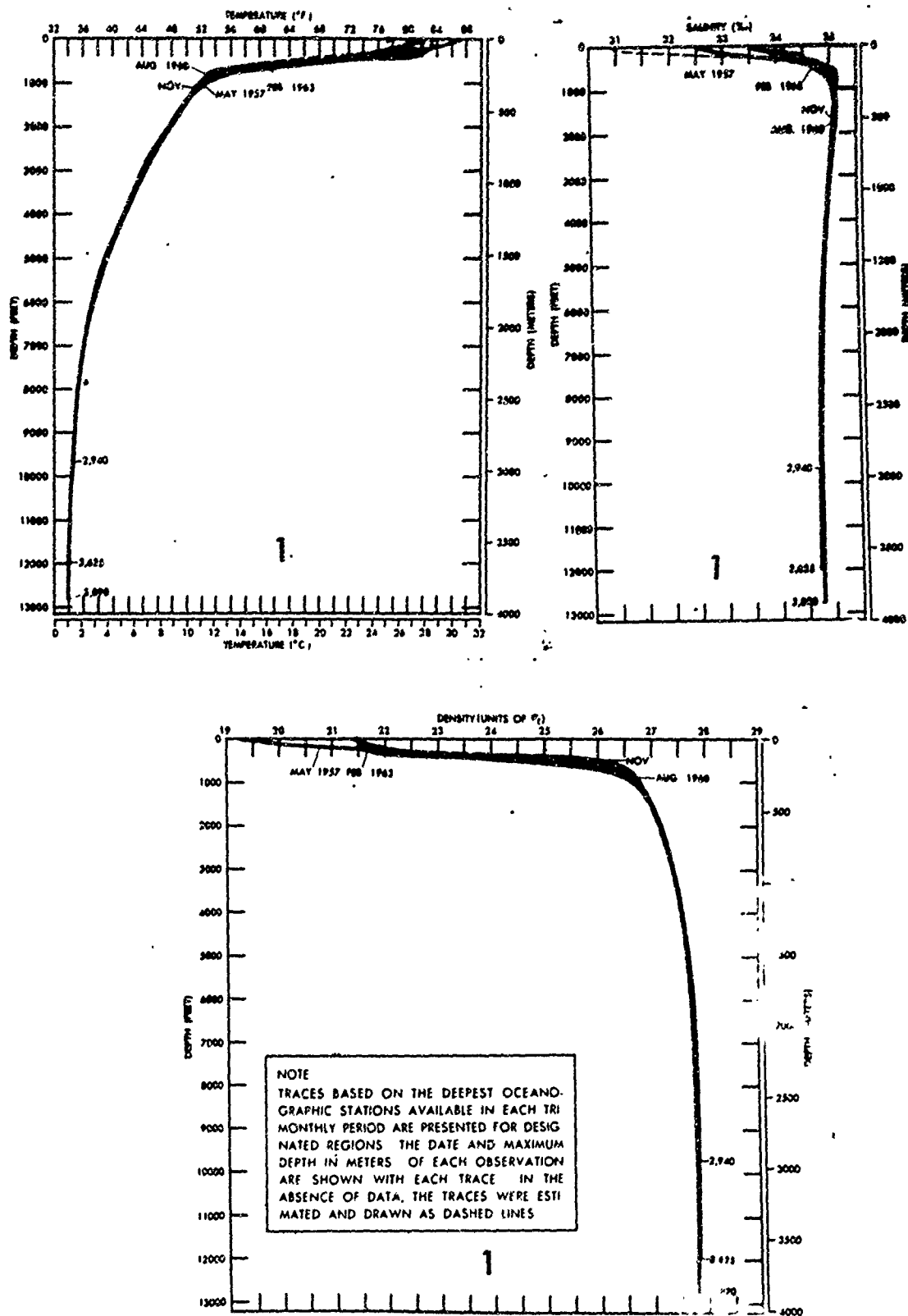


Figure 64 Deep traces of temperature, salinity, and density in Region 1

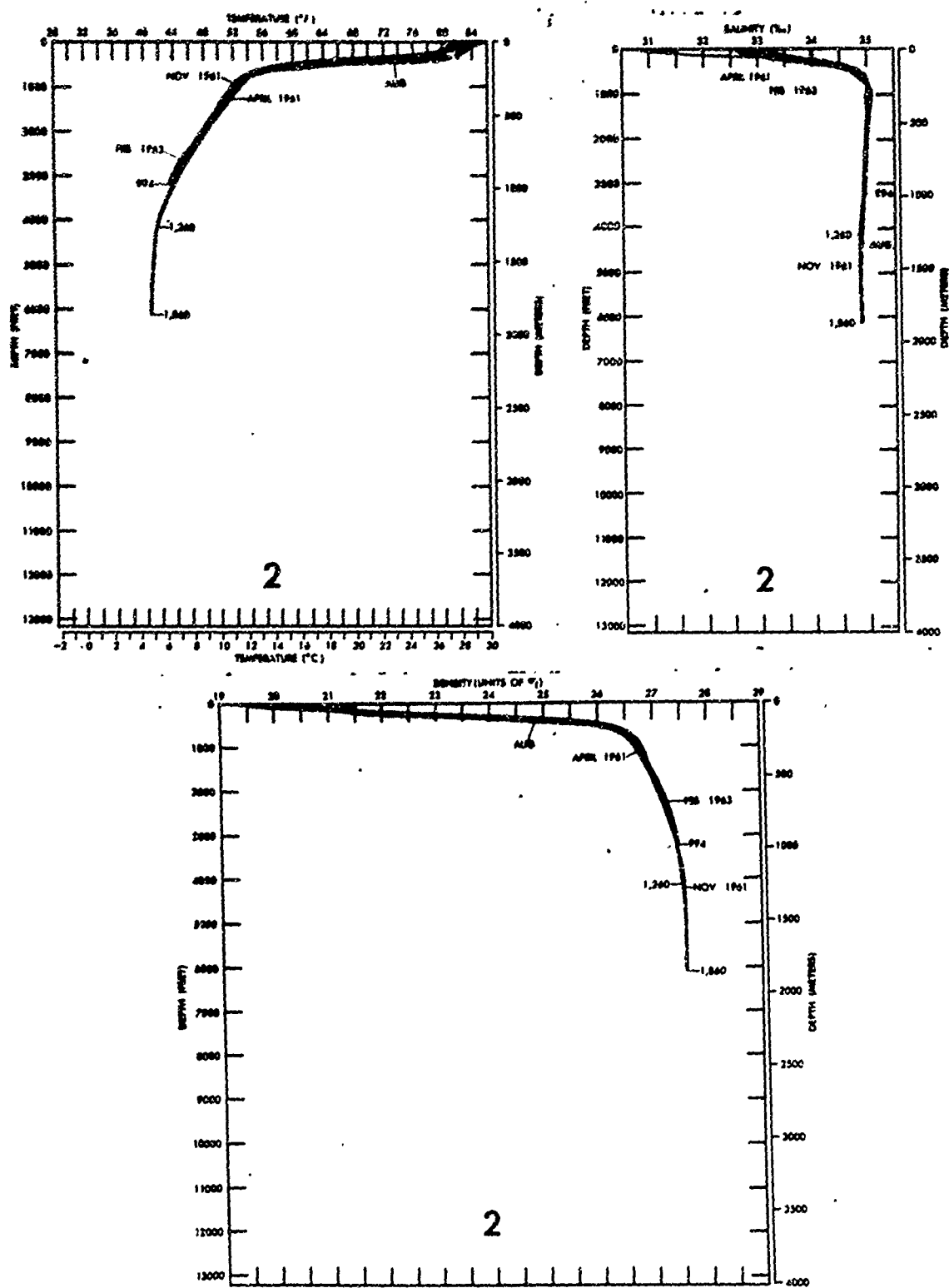


Figure 65 Deep traces of temperature, salinity, and density in Region 2

Unclassified
Security Classification

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13. ABSTRACT <p>The values and variations of temperature, salinity, and density in the Bay of Bengal and the Andaman Sea depend largely on the monsoonal regime. In addition, because of the semiencllosed geography of the region, water masses outside the area can influence the bay waters only from the south. The wind, rain, and land drainage cause a year-round low-salinity surface layer to form. Toward the end of the northeast monsoon, the surface waters in the Bay of Bengal and Andaman Sea become warmer and more saline, reaching the year's maximum for temperature and salinity in May. As the southwest monsoon approaches the east coast of India, the warm, highly stratified surface layers cool, tumble and mix thoroughly.</p> <p>Upwelling is a prominent feature of both monsoons. During the northeast monsoon it is prevalent along the coasts of Burma and eastern India, whereas during the southwest monsoon it occurs along the coasts of southwestern India and the Malay Peninsula.</p>			

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